Feeding Behaviour in Late Infancy

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Thesis submitted to the University of Durham,

Department of Psychology

for the degree of Doctor of Philosophy

September, 1998

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Abstract

The weaning period involves both a dietary and behavioural change. This may be an important time in the development of the kind of eating behaviour that continues into childhood. Evidence that the prevalence of childhood overweight and obesity is on the increase makes investigation of determinants of young children's eating behaviour important.

One-year-olds and their mothers (n=100) were observed during two of each child's meals. The variables were counts of observed behaviour. The mothers completed the Three-Factor Eating Questionnaire. Children's and mothers' weights and heights were measured. Although basically cross-sectional, the study had a longitudinal element as the children were followed up at 18 months for a further weight and length measurement.

A central feature of the thesis is the analysis of mealtime behaviour which takes place between one-year-olds and their mothers. The thesis shows how the structure of meals, before independent feeding is established, can be analysed. There is no evidence for the following relationships: differences in children's eating behaviour according to their mother's child feeding practices; differences in mothers' child feeding practices according to their self-reported eating characteristics; differences in the way boys and girls are treated at mealtimes; or differences in children's eating behaviour according to their sex. However, there is evidence that mothers' body weight is related to child feeding practices, and that children's body weight is related to eating behaviour. Two interesting observations are made at a single case level. The first is that one child whose eating behaviour was unusual is identified as failing to thrive. The second is that three of the mothers were severely obese and each gave their child food at a higher rate during the meals than any of the other mothers.

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Declaration

The research contained in this thesis was carried out by the author between 1995 and 1998 while a postgraduate student in the Department of Psychology at the University of Durham. None of the work contained in this thesis has been submitted in candidature for any other degree.

Statement of Copyright

Acknowledgements

First and foremost, I would like to thank my supervisor, Dr. Robert Drewett who has advised me along the way with diligence and clear-sightedness. And on a more personal note for his encouragement, support, and above all, for conducting our meetings with such good humour.

I am indebted to Dr. Rosemary McKenzie, consultant pediatrician for Gateshead Health Authority, for supporting my research project from the early planning stage until its completion.

I would like to thank all the mothers and children who took part in this study for giving up their time so generously. My thanks also go to the following medical centres for allowing me to recruit from their baby clinics: Longrigg Medical Centre, Fell Cottage Surgery and Beacon Lough Clinic.

Many thanks to the Royal Victoria Infirmary, Newcastle upon Tyne and Dr. Charlotte Wright for training me in the anthropometric measurement of children. Thanks also to Elmfield Health Group for allowing me to practise on some of their youngest clients.

My special thanks go to my mother and my husband Ray for spending hours collating data, meticulously and without complaint. My thanks go to Dr. Bridget Young and Dr. Mambwe Kasese-Hara for their input into the Behavioural Coding Inventory and Ms. Sally Corbett for scoring the questionnaires. Special thanks go to Ms. Jan Lister for her insightful help in devising a Coding Inventory and for conducting a reliability study so efficiently.

Thanks to everyone in the Psychology Department at the University of Durham who helped me in one way or another, especially Mr. Malcolm Rolling for technical help and Mr. Paul Thompson for IT support.

Finally, I would like to thank my family and friends for all their help and support. In particular, special thanks go to my mother for caring about my education over the years, and all the day-to-day practical help she has given me. Many thanks to my brother David, and his wife Julie, for taking such an interest in my study and its progress. Many, many thanks go to Ray for his usual cheerful support, help and encouragement. I really could not have done this research without him. And to my daughters Rebecca and Sally who always understood when things became hectic.

Dedicated to the memory of my father

Chapter One

Introduction

Basis for the study

Newborn human infants are naturally adapted to feed solely on milk for the first weeks of life. In due course (the time varies across cultures) the introduction of solids begins the weaning period. Traditionally the word 'wean' refers to the entire shift from breast milk to other foods. According to Greiner (1996), it is used to refer to four separate processes: to accustom the infant to some new food rather than provide any nutritional benefit; to complement breast milk when it no longer provides the complete nutritional needs of the child; to replace breast milk with other foods; and to stop breastfeeding altogether.

The process of weaning is complex for at least two reasons. First, although weaning is needed to provide the nutritional variety necessary for adequate growth and health (American Academy of Pediatrics, 1983), the child is typically neophobic (Birch and Marlin, 1982). This is thought to be the result of the 'omnivores's paradox'; food is needed for health but ingesting new substances is potentially hazardous. According to Kalat and Rozin (1973) different foods are gradually accepted if repeated experience with them does not result in negative consequences such as nausea or vomiting. Second, the infant has to make a developmental change in the way food and water is taken in. For example, the infant must learn new motor patterns such as chewing rather than sucking and later to feed autonomously using either their fingers or tools such as cutlery. Although weaning might correctly be taken to refer to a nutritional shift in the infant's diet, by necessity this shift involves the infant making behavioural changes in order to achieve this.

Many studies have investigated aspects of feeding behaviour at the milk feeding stage (e.g. Kron et al., 1963; Woolridge and Drewett, 1986; Wright et al., 1980) and a certain amount is known about eating behaviour in self feeding children (e.g. Barkeling et al., 1992; Drabman et al., 1979; Keane et al., 1981). However, very little indeed is known about eating behaviour in the stage during which the transition from one type of feeding to the other takes place. This is surprising, since the infant's first experience with solid feeding - the kind of feeding that continues into childhood - is an important starting point in learning about the development of later eating behaviour.

Recent research shows that childhood overweight has increased since the 1970s and its prevalence is currently high (Troiano and Flegel, 1998; Troiano et al., 1995). For example, Troiano et al. (1995) reported data from five separate surveys conducted on 6-17 years olds from 1963 to 1991. The data showed that overweight had increased among all sex and age groups over that time. Increases in the prevalence of childhood obesity have also been demonstrated. For example, Gortmaker et al. (1987) showed that over the 20 year period between 1963 and 1980, the prevalence of childhood obesity had increased by 54% in children aged 6-11 years and by almost 40% in adolescents aged 12-17 years. Childhood obesity is associated with the development of risk factors for cardiovascular and metabolic diseases (Smoak et al., 1987; Voors et al., 1976), and adolescent obesity with increased morbidity and mortality after a 50-year follow-up, independent of adult body weight (Must et al., 1992). Obesity in childhood also has adverse psychological effects. Wardle et al. (1995) showed negative stereotyping of obesity in children as young as seven years old and Kaplan and Wadden (1986) that obesity is associated with low self-esteem. Later lifestyle can also be affected: Gortmaker et al. (1993) showed that obesity in young women was associated with an adverse impact on household income, education, poverty and college completion. These effects persisted after controlling for factors such as parental education and the income of the family of origin statistically, suggesting that obesity is an important determinant rather than a consequence of socio-economic status.

Fatness is known to run in families but obesity cannot be explained simply in genetic terms. According to Bouchard (1996) between 30% and 50% of the variance in adiposity within a population is attributable to genetic differences so at least 50% is environmental in origin.

Heritability estimates do not provide information about the way genetics and the environment interact during development to produce obesity (Birch and Fisher, 1998). There are claims that parents facilitate the development and maintenance of obesity in their children in various ways. According to Klesges et al. (1986), for example, parents respond differently to their children's physical activity according to the child's degree of obesity; parents of obese children provide less reinforcement for activity than parents of lean children. There are also reports that parents can model eating behaviour (Birch, 1980; Harper and Sanders, 1975), provide prompts and reinforcement for patterns of eating (Klesges et al., 1986) and teach their children to override satiety signals by too much control during mealtimes (Johnson and Birch, 1994).

Although there are doubts over whether treatments for obesity are effective in adults (Garner and Wooley, 1991; Brownell and Rodin, 1994), there is some evidence that family-based interventions are effective in childhood. For example, a series of intervention studies with 6-12 year old obese children shows that obesity can be successfully treated (Epstein et al., 1990; Epstein et al., 1994). In a review, Epstein (1996) discusses the components of Epstein et al.'s family-based clinical treatment programme. The programme includes modifying energy intake, decreasing fat intake, increasing physical activity and changing parent-child interactions and the family environment around eating and physical activity. Epstein (1996) reports that two factors are useful in childhood obesity treatment: the direct involvement of at least one parent in the weight loss process improves short- and long-term weight regulation; and increasing activity to maintain long-term weight control is important. In view of the evidence for a rising prevalence of obesity in children, it is important for studies to identify environmental factors which prompt its development in the very early stages to assist the development of preventative measures and effective intervention treatments.

There is evidence that even infants control their own energy intake. Fomon et al. (1975) manipulated the concentration of milk formula fed to two groups of 1-16 week old infants and observed the effect on their milk intake. The infants were fed either a low (54kcal/100ml)[A] or a high (100kcal/100ml) concentration of milk formula by their mothers who were asked to feed their baby to appetite but were given no information about the formula's concentration. The group fed the low energy density formula consumed more milk than those fed the high energy density formula, although the total energy intake was significantly lower for the former group for the first seven weeks. After seven weeks, the energy intake was similar for both groups of infants. This demonstrates their ability to control energy intake by adjusting their formula intake in response to its energy density, consuming larger volumes of diluted formula than of concentrated formula. Fomon et al. (1976) also conducted an experiment during which one group of infants were fed a carbohydrate-rich formula and another were fed a fat-rich formula. Again the energy intake of both groups of infants was the same, demonstrating that infants are sensitive to the energy density of food intake rather than the source from which the energy is derived.

Davis (1928) pioneered work on infants' and young children's self-regulation of dietary intake. Newly weaned infants were provided with a selection of primarily fresh, unprocessed, unseasoned food that did not contain sugars or other sweeteners and allowed to select their own diet. The results showed that the children chose a healthy balanced diet without adult intervention. Much more recently, Birch et al. (1991) has investigated self-selection of food in children using more precise methods and a wider range of foods to reflect the availability of processed and sweetened foods much more common in children's diets during the 1990s. The choice of food offered

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[A] The SI base unit for energy is the joule (J), commonly quoted as the kilojoule (kJ). The calorie (cal) is 4.184 J, and the nutritional calorie (Cal) is 1 kcal or 4.184 kJ. The kcal is a non-SI unit, but as it appears in the original publications, I have quoted this unit in the thesis.

included cookies, syrup, corn chips and potato chips. The food intake of fifteen children aged 2-5 years was measured by weighing all foods eaten by each child during six days of assessment over a period of three weeks. The results showed that although the children's energy intake was highly variable at individual meals, total daily energy intake was relatively constant for each child; a high energy meal was generally followed by a low energy meal and vice versa. It was concluded that young children respond to the energy density of foods by controlling their intake at individual meals.

These studies provide evidence for an internal mechanism which enables energy intake to be controlled so as to remain relatively stable over 24 hour periods. This, in turn, suggests that infants and children control their intake according to the physiological consequences of ingested food. Birch and her colleagues have investigated features of this mechanism using an experimental design known as caloric compensation. This is a repeated measures design involving (at least) a pair of trials. Subjects are given a fixed volume of a preload to consume, followed by an opportunity to select food from a standard *ad libitum* meal from which they are able to eat to satiation. Afterwards the total energy intake from the preload and food eaten during each trial is calculated. Each pair of trials is identical apart from a difference in the preload, which is energy dense for one trial and energy dilute for the other. The rationale is that compensation is demonstrated by a higher intake of energy at the meal following consumption of the low energy preload even though the subjects are unaware of the preload's energy content. If this is demonstrated, then the energy density of the preload is assumed to have affected subsequent food intake.

Birch and Deysher (1986) used this design to investigate children's caloric compensation. Twenty one 2½-5 year olds were given a preload on two occasions in the form of a pudding (40kcal/100ml for one trial and 150kcal/100ml for the other). This was followed by an *ad libitum* lunch. The children consumed much less at the meal following the high energy pudding than the one following the low energy pudding, resulting in a similar overall energy intake on the two occasions for the preload and *ad libitum* lunch combined; the mean total consumption was 260 kcals and 269 kcals in the high and low preload conditions respectively. It was concluded that children adjust their food intake to compensate for the energy density of a preload. The same experiment included a group of adults which showed that the amount of food eaten at the *ad libitum* meal after the high energy preload was only slightly less than after the low energy preload; the mean total consumption was 522 kcals and 422 kcals in the high and low preload conditions respectively. The overall energy intake for the adults then, was much greater on the occasion with the high energy preload than the low energy preload. So, although exactly the same procedure is used for both children and adults, on average children adjust their intake in response to a preload very precisely whereas on average adults do not.

However, this average effect does not in itself show that *individual* children have the ability for near-perfect caloric compensation. The results are based on analyses comparing the mean energy intake of the group for each pair of trials, and these means do not reflect the considerable variability in individual children's ability to compensate. The degree to which an individual child adjusts energy intake in response to a preload has been quantified by using a compensation index referred to as COMPX (Johnson and Birch, 1994). The COMPX value is calculated for each subject using the following formula:

$$\frac{\text{ad lib. kcal (low energy preload)} - \text{ad lib. kcal (high energy preload)}}{\text{drink preload kcal (high)} - \text{drink preload kcal (low)}} \times 100\%$$

The numerator is the difference between the child's energy intake at the *ad libitum* meal following the high and low energy preloads, and the denominator is the difference in energy content between the high and low energy preload. Their ratio is expressed as a percentage to arrive at COMPX. For example, if a low energy preload contains 150 kcal less than a high energy preload, perfect 'calorie-for-calorie' compensation is shown if a child eats 150 kcal more after the low energy preload than after the high energy preload. COMPX, then, reflects the precision of the adjustment of intake in response to the energy density of the food eaten. It can be used to place children on a continuum from under-compensation (eating more after consuming a high energy preload) to over-compensation (eating less after consuming a high energy preload by more than the energy content of the preload). A value of 100% reflects 'calorie-for-calorie' adjustment; smaller or negative values reflect incomplete compensation and larger, positive values reflect over-compensation. Johnson and Birch (1994) claim that COMPX is a relatively stable measure of individual children's ability to control energy intake. They investigated this by obtaining two COMPX measures from twenty eight children at approximately yearly intervals. They found a significant correlation in COMPX between the two measures (r=0.42). This is not a very high correlation, and no other data exist on the stability of COMPX. It is important that this is replicated in other studies so that the issue of whether COMPX is a characteristic of individual children can be resolved.

Johnson and Birch (1994) used COMPX to investigate whether children's responsiveness to energy density is influenced by parental characteristics, and whether individual differences in energy control are related to adiposity. A sample of 77 children aged 2-4 years consumed the high and low preload on two separate occasions, each followed by an *ad libitum* self-selected meal twenty minutes later. Parental influences on the children's eating style were assessed by asking mothers and fathers to complete the Three-Factor Eating Questionnaire (TFEQ) (Stunkard and Messick, 1985) which assesses restraint (cognitive control of food intake), disinhibition (difficulty in stopping eating once the individual has started) and perceived hunger (the experience of hunger and how it affects eating behaviour). Parents also completed a Child-Feeding Questionnaire to assess the degree of control that parents use in feeding their children, and answered ten open-ended questions related to qualitative aspects of the child's eating. The COMPX value was correlated with the parents' child feeding practices, the parents' own self-reported eating characteristics, and the children's anthropometric measures. The results showed a number of relationships between these measures and children's ability to control their energy intake.

First, parents who reported a higher degree of control in the feeding situation had children who showed less evidence of the ability to calorie compensate.

Second, parents who scored high on the disinhibition scale of the Three-Factor Eating Questionnaire had children who showed less evidence of caloric compensation. The authors suggest three possibilities here. Successful and unsuccessful dieting parents may approach the feeding of their children in different ways, or they may differ in their capacity as role models, or there may be some genetic basis for familial similarities in the control of energy intake.

Third, although no significant correlations were found between children's anthropometric measurements and their COMPX scores overall, when the skinfolds of children with COMPX scores in the lowest quartile were compared to children with COMPX scores in the highest quartile, it was found that the children who compensated poorly were significantly fatter.

Fourth, two sex differences were found when the data were analysed separately for girls and boys. First, the mother's self-reported eating characteristics were examined with COMPX, and dietary restraint was found to correlate positively with COMPX for boys, but negatively for girls. This raises the possibility that sex differences in the ability to control energy intake may originate in the way in which girls are treated during meals. The second was the finding that there was a significant negative correlation between COMPX and skinfolds for girls ($r=-0.37$). However, boys overall showed the clearest evidence of caloric compensation; there were significant positive correlations between weight and COMPX ($r=0.35$), and between weight/height and COMPX ($r=0.37$). Although skinfolds were shown to be similar for boys and girls, they were significantly associated with weight/height for girls but not boys. The authors suggest that an increase in girls' weight/height may be related to body fat whereas an increase in boys' weight/height may be an increase in lean body mass. If so, this would suggest that boys with a higher percentage of lean body mass compensated for energy more accurately which links well to the finding that boys compensated better than girls overall.

To summarise, this study finds evidence that parents' child feeding practices and their own self-reported eating characteristics are related to their children's ability to calorie compensate; that the higher the children's skinfolds, the poorer their ability to calorie compensate; and that there are sex differences in the ability to calorie compensate. These four findings are central to the thesis, and were the initial stimuli to the work reported in it.

There are, however, two difficulties in interpreting the results reported by Johnson and Birch (1994). First, the finding that the children of parents who reported a higher degree of control in the feeding situation showed less evidence of caloric compensation is important in the light of evidence that parental feeding strategies used to encourage children to eat healthy foods in sufficient quantities are counterproductive (e.g. Birch et al., 1980; Birch et al., 1984; Birch et al., 1987). However, the authors state that it was the responses from the Child-Feeding Questionnaire items that *significantly correlated with children's COMPX scores* that were summed to produce a parental control index. Analysing the data in this way was bound to lead to the finding that mothers who indicated more control in the feeding situation had children less responsive to the energy density of food. More rigorous research needs to be conducted to test their claim that parental control in the feeding situation upsets children's ability to control energy intake.

The second difficulty with Johnson and Birch's study is a problem in interpreting exactly how the COMPX scale was analysed in relation to other variables. They describe COMPX as a continuum of negative and positive scores with 100% showing 'calorie-for-calorie' compensation. Correlation coefficients cannot be interpreted without knowing the range of scores, and the range reported in the paper gives negative and positive COMPX scores (–80% to 230%). However, because 100% COMPX shows good compensation, scores at either side of 100% show poor compensation. It follows then, that if the authors used the range of scores as reported, the negative correlation would not show the effect they claim it does. If, on the other hand, the data were transformed to fit a range, say, of 0% to 100%, then a negative correlation would show an association between mothers with high restraint and poor caloric compensation by the child. However, it is not clear from the publication that this was the case. Despite the difficulties in interpreting the results, the findings from this paper are very widely quoted. The issues raised by the study are potentially important and require further investigation, but it is important to bear limitations in the analysis and reporting in mind because they may have resulted in incorrect interpretation.

Parental feeding and mealtime interactions

The data from Fomon's work on milk consumption show that infants adjust their energy intake according to the formula's energy density from about seven weeks. One possible explanation for the finding that infants younger than seven weeks increase their intake but not sufficiently to achieve similar overall energy intake may be that this reflects a ceiling effect; they cannot increase their intake sufficiently to compensate for the low energy density of the formula. However, the view that these results suggest an innate capacity to learn about the consequences of ingestion, rather than evidence for an innate ability to control energy intake is supported by evidence that young children can also learn the effect of the physiological consequences of eating foods when given the opportunity to do so. Birch and Deysher (1985) have shown this in an experiment using caloric compensation methodology. Children aged 3-4 years were given the opportunity to learn to associate two distinctively flavoured foods with differing energy densities. They received a series of six pairs of training snacks. Within each pair, each flavour of pudding was paired with either a high (155kcal/100ml) or low (40kcal/100ml) preload followed by an *ad libitum* meal. After the training trials had taken place, an 'extinction' test pair of trials was given. These were identical to the training trials except that both flavours of pudding were of intermediate density (95kcal/100ml). Consumption was recorded after each trial had been completed. The results showed that during training the children ate more following the low energy preload than the high energy preload, and this difference became more pronounced over trials. It was also found that during the extinction test trials the children ate significantly more following the flavour of preload previously paired with the low energy than high energy density. The children, then, showed signs of learning about the consequences of ingestion in two ways. First, they compensated more and more accurately for the preload's energy content over trials. Second, they subsequently consumed food according to this learned response in further trials, even though the energy content of the preload had changed.

In the usual home environment, though, children's eating behaviour is not simply controlled by physiological feedback in response to ingestion. Mealtimes and eating are social activities and there is evidence that mealtimes provide opportunities for children to learn about food intake control in relation to particular social contexts. Birch et al. (1987) designed an experiment using caloric compensation to test whether contrasting child feeding practices have an impact on children's responsiveness to energy density as a control of meal size. In this instance, Birch et al. investigated the effect of differences in degree of external control imposed by adults on children's food intake, by studying the extent to which either internal cues (e.g. hunger) or external cues (e.g. how much food is left on the plate) influences their intake. Children received three pairs of conditioning trials followed by two pairs of extinction test trials, each consisting of a preload and *ad libitum* snack. The preloads were either high or low energy and each was paired to a different distinctive flavour. The children were randomly assigned to one of two conditions: an 'internal' condition during which the children were encouraged to focus on sensations of hunger and satiety and to stop eating the *ad libitum* snack when they felt full; or an 'external' condition during which the children were encouraged to focus on cues such as the time of day and the amount of food left on their plate. The extinction test trials differed in that the preloads were of an intermediate density, so only the flavour cues were available during extinction, and the social context cues were eliminated. Children assigned to the internal condition showed evidence of responsiveness to energy density cues, eating more following the low than the high energy density paired flavour. Those in the external condition showed no evidence that their eating was influenced by the energy density of the preload, or that they had learned any association between the flavour of the preload and its post-ingestive consequences. This evidence is consistent with the theory that children not only learn about the consequences of ingesting food, but also learn about other cues that are relevant in the control of food intake.

Birch and her co-workers have also investigated the effect of social experience on food preferences in pre-school children. In order to do so, they have developed a preference assessment procedure during which children are asked to taste each food individually and categorise them as 'like', 'dislike' and 'just okay'. The children are shown three cards with different cartoon drawings on them representing the appropriate facial expressions for the three categories to aid their decisions. They are asked to place all the foods next to the appropriate faces and afterwards to rank all the foods within each category in order of preference. Using this technique the experimenters can select the food from the range that the child has the most 'neutral' preference for, the rationale being that this food has the most potential to yield increases and decreases in preference over the course of the subsequent experiment.

Birch et al. (1980) used this technique to study the effect of rewarding children for certain behaviour on food acceptance. They repeatedly presented a neutral food to young children in one of four social-affective contexts: as a reward for a defined category of good behaviour; non-contingently paired with adult attention (the child did not have to behave in a certain way in order to get the food); in a non-social context (the child could get the snack out of his/her locker whenever they wanted); or at snack-time (a control group). Food preferences were assessed before beginning the series of presentations, after the end of six weeks of presentations and again after a further six weeks had elapsed. Presenting the snacks as rewards and non-contingently with adult attention produced significant increases in preference and this effect persisted for at least six weeks following termination of the presentations. No consistent changes in preferences were observed for food presented in either the non-social context or control condition. This indicates that strategies that parents commonly use systematically influence children's food preferences. Birch (1981) also found that preference for a food could be significantly enhanced by consistently pairing its consumption with positive, adult attention showing that actual praise for eating the food is not necessary. Furthermore, this enhanced preference generalises to other foods within the same food category.

In a further study Birch et al. (1984) wanted to test the theory of extrinsic motivation, which predicts that rewards for performing activities reduce the attractiveness of those activities. Specifically, they wanted to establish whether instrumental consumption (consumption of a particular food has to occur before a reward can be given) affects food preferences. Children were assigned to either an experimental group receiving either an extrinsic or verbal reward, or to a control group receiving no reward. Half of each of the experimental groups were rewarded for drinking a drink while the other half were rewarded for drinking more than their spontaneously consumed quantity. Exposure to the drink was equivalent across conditions. The results showed that in all the experimental groups there was a significant reduction in preference for the drink, and that this reduction was of a similar degree in all four groups. Conversely, preference for the drink increased slightly but not significantly for the control group. The contrasting shifts in preferences between experimental and control groups provide evidence that young children can distinguish between differing mealtime contexts, and depending on the context, the food's acceptability increases or declines. It was concluded that making a reward conditional on consuming a food negatively affects food preferences.

Some studies have observed actual eating behaviour in natural settings to establish whether parental characteristics influence children's eating behaviour. Klesges et al. (1983) investigated the relationship between parent-child interactions at mealtimes and the relative weight of the child in 12-36 month old children by observing the children and their parents during two lunchtime meals. They used a partial interval time-sampling system (10 seconds observation and 10 seconds recording) over the course of the entire meal. The behaviours recorded included the percentage of time spent eating, playing with food, crying, talking, requesting food, refusing food, spitting out food, away from table and engaged in other activity. Interactions between the child and other family members relating to food, namely encouragement and discouragement to eat, food offers and modelling of eating, were also recorded. The authors report that parental prompts to eat (defined as presenting and offering food as well as encouraging its consumption), parental food offers and parental encouragement to eat were significantly positively correlated to the relative weight of the child. The authors do not state what relative weight refers to - presumably it refers to weight for height and sex. Although this finding does suggest that parental variables correlate with the child's relative weight, there are difficulties in interpreting the results. Not only was the sample very small (14) but the results are complicated by age due to the wide age range of the children; as younger children are less autonomous in the feeding situation they are likely to be more actively encouraged and helped to eat by parents. The authors themselves acknowledge that developmental changes may have affected the results. This highlights the need to conduct research on children's eating behaviour using samples with a narrow age range during periods of rapid development.

Koivisto et al. (1994) have also investigated the effect of social aspects on child feeding behaviour within a natural setting. The aim was to investigate the relationship between parental mealtime practices and children's food intake. The evening meals of a sample of fifty 3-7 year old children were video recorded in their own homes. The video tapes were coded using a continuous coding procedure using a coding scheme similar to that used by Klesges et al. (1983) and analysed to assess parental behaviour and child eating behaviour. A seven-day weighed food-intake diary was kept for 39 of the children and energy intake calculated from it. Energy intake was found to be negatively related to the counts of parental assistance and negative statements about the child. Significant positive correlations were found between energy intake and counts of the child 'taking food on the recommendation of the parent'. However, statistical significance was lost when age was taken into account. This again shows that it is important to study children within a narrow age range, especially so when the sample is relatively small. If progress into the area of children's feeding behaviour is to be made, it is important that the problems of studying children when they are going through periods of rapid development are recognised. In investigating aspects of behaviour which already includes wide individual differences, there needs to be stringent criteria for selecting samples with narrow age ranges to ensure that the data collected will reflect the variety of behaviour which occurs at that particular age.

Birch et al. (1981) tried to establish whether there are relationships between mother-child interaction and the degree of fatness in children by observing 21 children in an eating and non-eating situation when they were 3-7 years old. Skinfold thicknesses were used as an index of fatness. Observation took place in a laboratory for the eating situation and in the child's home for the non-eating situation, and the results showed that mothers of fatter children talked less to their children in both settings. It was also found that thinner children and their mothers ate less food, ate at a slower rate and talked to each other more during lunch than fatter children and their mothers. The observations for the eating situation were conducted under laboratory conditions, so the data may not reflect the usual behaviour of the mother and child.

Agras et al. (1988) investigated the possibility that parent's eating styles are socially transmitted to their children. They studied the relationship between the eating behaviour of 29 children aged 18 months and their parents. Each was provided with a standard 'buffet' style selection of foods and observed individually on separate occasions as they ate in a controlled laboratory environment. The index children ate with their mother present to achieve a more natural situation for the child. Eating behaviours were coded and energy intake measured by weighing the foods before and after observation. Three eating behaviours were significantly related in parents and children: active feeding time, bite frequency and energy intake. In addition, children with higher energy intakes tended to have mothers who ate rapidly and fathers who had longer meal durations. This study shows relationships between parental and child eating behaviours which the authors claim are the result of social transmission from parent to child.

It can be concluded that children can control their energy intake accurately and that they learn about the physiological consequences of ingestion with repeated experience. However, their control of food intake is also sensitive to social cues. Birch's body of research provides very good evidence that the context in which foods are presented to children is important in the development of food intake control and food preferences. Birch et al. (1987) showed that encouraging children to focus on external factors (such as how much food is left on the plate) rather than internal factors (such as hunger) upsets children's ability to adjust for the energy content of preloads in calorie compensation experiments. It is common for parents to believe their children eat insufficient quantities of food, and although Birch and Marlin (1982) have shown that preferences in 2 year olds are highly correlated with the frequency of exposure to a particular food, parents often try to increase their child's food intake using a variety of strategies. The results of the studies mentioned above by Birch et al. suggest that at least two particular child feeding practices have the opposite effect to those intended by parents. First, parents employ instrumental eating to increase the child's food consumption, and it reduces preference for the food making it more likely that the food will not be eaten once the contingency (reward) is removed. In addition, using contingencies makes the implicit assumption that the child does not have the ability to control intake in response to internal, physiological cues of hunger and satiety. Second, foods used as rewards appear to increase preference for those foods, and it is typically highly palatable foods that are used as rewards.

Although Birch's body of research provides good evidence that the context in which foods are presented to children is important in the development of food intake control and food preferences, this work neither investigates mothers' child feeding practices nor children's actual eating behaviour. If parental feeding practices are to be implicated in hindering the child's attempts to control their own energy intake, it is vital that mothers, as the typical main caregiver, are actually observed in the feeding situation. A small amount of research has attempted to address these issues, and these studies report preliminary findings about parental characteristics and their children's eating behaviour, but the results are based on small samples of children of widely varying ages. It is important that children's actual eating behaviour is investigated using observational techniques, but with much larger samples selected using far more rigorous criteria than previously, and in natural situations.

Influence of maternal eating characteristics

There is a small amount of research which has investigated whether there are any relationships between mothers with eating disorders and their own child feeding practices, and their children's feeding behaviour. The two main categories of eating disorders are anorexia nervosa (AN) and bulimia nervosa (BN). According to Fombonne (1995) AN is defined by 'weight loss, fear of gaining weight or becoming fat despite the fact that the subject is excessively thin, disturbed perception of body image and shape and, in females, a stop to menstruation'. BN shares the core features of excessive concern with body shape and weight with AN and is 'characterised by recurrent episodes of binge eating ... and the use of drastic means of weight reduction such as overdoses of diuretics and laxatives, and excessive dieting or physical exercise, while body weight remains roughly in the normal range' (Fombonne, 1995).

There are difficulties in assessing the prevalence of eating disorders in women of child-bearing age: a central characteristic of eating disorders is concealment and secrecy, so those who suffer them may tend to avoid taking part in surveys. Beglin and Fairburn (1992) showed that this is the case: in a survey conducted in the UK to determine the prevalence of AN, 39 out of 285 women of child-bearing age (16-35 years), failed to take part. However, further research showed that of these, three met the criteria for AN in the past and one met the criteria currently. From this information the true lifetime prevalence for AN of 1.4 per cent was calculated (Beglin and Fairburn, 1992). According to Bushnell et al. (1990) the lifetime prevalence for BN was 4.5 per cent among women aged 16-24 years and 2.0 per cent among those aged 25-44 years.

Evans and le Grange (1995) compared ten current or previous eating disordered mothers with ten control mothers. They found that the eating disordered group of mothers were more likely to schedule feed their babies and were more anxious about mealtimes if their infants did not adhere to the feeding schedule advised by health professionals. This seems to be analogous to the control such mothers impose on their own eating habits.

Stein and Fairburn (1989) studied five women with severe bulimia nervosa with children under the age of six years (including one mother who also had an eight year old). The mothers were interviewed about their child rearing and feeding practices and about their attitudes towards the shape and weight of their children. All five mothers had had difficulties breast feeding and three of the children had major feeding problems; one had non-organic failure-to-thrive and his sibling was severely overweight, and the other child was resistant and difficult to feed. Three of the mothers were unduly concerned about the shape and weight of their children and were anxious to keep their children's weight down. Stein et al. (1994) also studied two groups of first-time mothers. One, the index group, had had an eating disorder during the post-natal year and the other, a control group, had not. The mothers were observed with their infants over two periods, once during a normal evening mealtime and once during a playtime. The index mothers were more intrusive during both periods of observation than the controls. The index mothers also expressed more negative emotion towards infants during mealtimes (but not during playtime).

Stein et al. (1995) investigated the issue of feeding disturbances in young children and related it to the mothers' self-reported eating characteristics. They matched all the children with a feeding disorder (*n*=30) within a particular district to children with behavioural problems. The children's ages ranged from 2-12 years. The mothers of all the children were asked to complete the Eating Disorder Examination Questionnaire which has subscales of dietary restraint, bulimia, concern about eating, concern about body shape, and concern about weight. It was shown that the index group of mothers scored significantly higher on all five subscales of the questionnaire, providing evidence that feeding disturbances in children are associated with disturbed eating habits and attitudes among mothers. Stein et al. (1995) suggest that disturbed eating characteristics among mothers may play a role in feeding disturbances in children.

The evidence cited above focuses on mothers with clinical eating disorders, and though causal relationships cannot be determined from cross sectional studies, the findings implicate parental variables in children's eating behaviour. There is evidence that the family environment influences their children's eating behaviour, for example, by role modelling (Birch, 1980). It seems plausible, therefore, that mothers with particular eating habits and attitudes towards eating (rather than clinical eating disorders) may also influence children's eating behaviours. One study that investigates this possibility, although it does not observe actual eating behaviour, was conducted by Johnson and Birch (1994). They hypothesised that parents' self-reported eating characteristics might have an impact upon their children's ability to control energy intake. An ordinary sample of mothers were measured for self-reported eating characteristics and their children completed a caloric compensation experiment. Johnson and Birch (1994) found that mothers who reported high levels of dietary restraint had daughters who showed less evidence of energy intake control than the daughters of low restraint mothers. The term 'restrained eating' refers to the tendency to restrict food intake. This is commonly known as 'dieting', and its aim can be either to achieve or to maintain a desired weight.

The concept of restrained eating was originally used to explain differences in eating behaviour between obese and non-obese persons. Nisbett (1972) claimed that there were 'striking behavioural parallels between obese individuals and hungry individuals'. He proposed that obese people experience hunger because they attempt to hold their weight below its biologically dictated 'set point'. Stimulated by this idea, Herman and Mack (1975) pursued the theory that differences in eating behaviour between obese and non-obese persons were actually due to more frequent dieting by obese persons. They tested this by conducting an experiment on normal weight women separated into an unrestrained and restrained group of subjects according to scores on the Restraint Scale (Herman and Mack, 1975). This is a 10-item questionnaire devised for the purpose of assessing individuals on their degree of restraint. Half the subjects in each group were given a milk shake preload and the other half no preload before an ice cream taste test. The unrestrained eaters ate less in the preload condition, but the restrained eaters ate more. This paradoxical behaviour is termed 'counter-regulatory overeating', and the finding that restrained subjects become 'disinhibited' on consuming a preload has since been reported several times among normal weight people (e.g. Herman and Polivy, 1980; Hibsher and Herman, 1977; Ruderman and Christensen, 1983; Ruderman and Wilson, 1979).

According to Ruderman (1986), the 'disinhibition' hypothesis proposes that the self-control of restrained eaters is temporarily interfered with by certain events or 'disinhibitors' after which large quantities of food are consumed. Further studies have shown that counter-regulatory overeating is triggered by the perception of the energy content of the preload rather than its actual energy content (Polivy, 1976; Spencer and Fremouw, 1979; Woody et al., 1981). Disinhibition has also been shown to occur in individuals in particular emotional states such as depression or anxiety. Depressed restrained eaters gain weight, whereas depressed unrestrained eaters lose weight (Polivy and Herman, 1976). Similarly, anxious restrained eaters eat more than anxious unrestrained eaters (Herman and Polivy, 1975).

However, difficulties with the Restraint Scale appeared when it was applied to obese persons. The most robust finding that normal weight restrained eaters counter-regulate was not shown in obese subjects who scored high on the Restraint Scale. They did not overeat following a preload (Hibsher and Herman, 1977; Ruderman and Christensen, 1983; Ruderman and Wilson, 1979; Spencer and Fremouw, 1979) and indeed one study showed that obese subjects ate less following a preload (Ruderman and Christensen, 1983). This suggested that the Restraint Scale did not predict the behaviour of obese people.

Another problem with the Restraint Scale lay in its construct validity; it has been found to measure two factors. Rather than measuring restraint or concern for dieting alone, it also measured fluctuations in body weight (Blanchard and Frost, 1983; Drewnowski et al., 1982; Johnson et al., 1983; Lowe, 1984). Weight fluctuation is highly correlated with percentage overweight (Bray, 1976) which may lead to erroneous classification of the obese; even when not restricting food intake, obese individuals may score higher on the Restraint Scale because of greater fluctuations in body weight. Drewnowski et al. (1982), indeed, showed that just two of the weight fluctuation items accounted for 70% of the variance in total scores on the Restraint Scale, and the obese subjects actually scored lower on the dietary concern factor. So numerically equivalent scores on the Restraint Scale in obese and normal weight subjects may be due to other characteristics of the subjects rather than actual restraint. This could explain why the results of restrained non-obese groups have not been replicated in restrained obese groups of subjects.

Due to problems with the Restraint Scale, Stunkard and Messick (1985) devised a new instrument to measure restrained eating and related issues. An initial pool of 67 questionnaire items was derived from Herman and Polivy's revised Restraint Scale, the Latent Obesity Questionnaire (Pudel et al., 1975) and 17 new items based on clinical experience. Three groups (very restrained eaters, very unrestrained eaters and an intermediate group) were selected to complete the initial 67-item questionnaire. The three factors of restraint, disinhibition and hunger emerged from factor analysis. New items were developed to increase the distinctiveness of each factor, and the new 93-item questionnaire was administered to three groups of subjects similar to the previous sample. The three independent factors of cognitive restraint, disinhibition and hunger again emerged from factor analysis. A 51-item scale known as the Three-Factor Eating Questionnaire (TFEQ) resulted from this analysis.

Studies suggest that there are distinctive types of restrained eating behaviour, one associated with high disinhibition and the other with low disinhibition. Westenhoefer (1991) created two groups from a large sample of people registered for a computer-aided training programme for weight reduction. They selected those with moderately high restraint scores (10-13 inclusive) coupled with either very low or very high disinhibition scores on the TFEQ. The whole sample, then, was homogeneous in terms of dietary restraint. It was found that certain restraint items were associated with low and high disinhibition indicating that different strategies were used by the two groups to restrict intake. Low disinhibition was associated with controlling everyday eating behaviour such as taking small helpings and eating more slowly, whereas high disinhibition was associated with strategies centred on calorie counting, avoiding some foods and consuming low energy foods. The former type of restraint was labelled flexible control or consistent restraint. The latter type was labelled rigid control or inconsistent restraint. This study indicated that the factors of restraint and disinhibition should not be considered in isolation.

Westenhoefer et al. (1994) investigated this further in a sample of normal weight women who completed the TFEQ. On the basis of their scores they were divided into four groups. Using a median split for restraint (0-8 or 9-21) and disinhibition (0-5 or 6-16), subjects were assigned to a 'high restraint/high disinhibition' group, 'high restraint/low disinhibition' group, 'low restraint/high disinhibition' group or a 'low restraint/low disinhibition' group. All subjects in each group were randomly assigned to either the preload condition or a no preload condition. The preload was a 200 ml milkshake. The subjects then participated in an *ad libitum* ice cream taste test. The disinhibition effect only occurred in subjects with high scores on both the restraint and disinhibition scales. Westenhoefer et al. (1994) proposed that high susceptibility to eating problems may be caused by rigid control of eating behaviour whereas flexible control of eating behaviour may be a less problematic strategy of long-term weight control.

To return to Johnson and Birch (1994), these authors reported two relationships between children's energy intake control and parental self-reported eating characteristics. First, girls with mothers high in dietary restraint were less able to calorie compensate although the correlation missed statistical significance. The authors suggest that girls and boys may be treated differently in the feeding situation, resulting in different styles of intake control. This reported link between children's energy intake control and mothers' levels of dietary restraint could be important in the child's future relationship with food and eating. It is especially likely in the light of evidence from Hill et al. (1990) who report a strong relationship between the degree of dietary restraint in mothers and their 10 year old daughters. Second, Johnson and Birch (1994) reported that parents (mothers and fathers) scoring high on the disinhibition scale had children with less ability to calorie compensate, and suggest three possible explanations for this: differences in the way the children of high disinhibition parents are fed, the role models these parents provide for their children or genetic influences.

Johnson and Birch (1994), then, found relationships between parental self-reported eating characteristics (restraint and disinhibition) and children's style of intake control. This is interesting in view of recent findings suggesting that restraint needs to be considered in conjunction with disinhibition, although the differences Johnson and Birch showed for restraint was found in mothers and daughters, and that for disinhibition was for both mother and father, and their sons and daughters. In women high scores on both the restraint and disinhibition scales predict problem eating (Westenhoefer et al., 1994). This suggests that it is important for future investigations into mothers' self-reported eating characteristics and the way they interact with their children during mealtimes to consider the scores from both subscales.

Body weight and eating behaviour in children

Previous studies suggest that there is a relationship between body weight and eating behaviour. Given that the prevalence of childhood overweight is on the increase and has been associated with negative medical and social outcomes, it is important to establish the way in which genetics and the environment interact during development to produce obesity (Birch and Fisher, 1998).

In a literature review Spitzer and Rodin (1981) conclude that there are two major differences in eating behaviour between obese and normal weight individuals: the obese are more likely to consume large quantities of highly palatable foods and their eating rate is less likely to slow down during the course of a meal. This conclusion is based on research conducted on adults, and currently only a very small amount of research exists on the relationship between body weight and eating behaviour in children. The research which does exist has tended to be conducted on school age children with fully independent eating.

Drabman et al. (1979) investigated this issue in three groups of children (18-24 months, 3-4 years and 5-6 years old) by classifying them as overweight or normal weight on the basis of observer judgements. All sixty children were observed in the school cafeteria while eating a standard school lunch. A time-sampling procedure (30 seconds observation and 10 seconds break) was used. This continued for ten sample intervals to arrive at a total of five minutes observation, unless the child stopped eating before this was completed. The variables recorded were number of bites of food, chews per bite, sips of drinks and talks with other children. In all age groups, the overweight children took more bites per 30 second interval and fewer chews per bite than the normal weight ones. With the exception of studies on infants feeding solely on milk, few studies have attempted to study feeding behaviour in children as young as 18 months. In this study the youngest group were 18-24 months old, and the relationships between eating behaviour and body weight were found in them as well as in older children. However, this finding may not be generalisable to all children of this age because Drabman et al.'s selection criteria specified that only self-feeding children would be observed. Another problem with this study is that only a small segment of the total feeding episode was recorded due to the time-sampling procedure used and because only ten sample intervals were recorded. This may not provide reliable estimates concerning the feeding behaviour that takes place over entire meals.

Keane et al. (1981) investigated eating behaviour and concurrent weight using height and weight measurements from the health records of twenty 11 year olds. Half the children were overweight (mean 36% overweight, range 23% to 65% overweight for height and age) and half were of normal weight (mean 1% underweight, range 6.8% overweight to 7% underweight for height and age). The children ate a standardised meal on their own in a laboratory setting, and their eating behaviour (duration of meal, number of bites and sips) was recorded using a time-sampling procedure. Keane et al. report that the obese children had a shorter meal duration than the non-obese children; although there was no difference in the total count of bites and sips, the obese children took more bites per minute and ate the standardised meal in approximately half the time it took the non-obese children. Keane et al. justified observing children individually in a controlled laboratory setting as a way of reducing concurrent activities such as talking during the meal. The results are interesting, but are not necessarily valid for several reasons. There is the issue of ecological validity; eating and mealtimes are essentially social occasions so arriving at conclusions based on behaviour with the child isolated may be misleading. The children were asked to consume the entire meal. The authors do not report whether or not the children followed this instruction, so it is not possible to know what the effect this instruction may have had on subjects. Nevertheless, it seems likely that it will have affected the children's eating behaviour in some way.

Barkeling et al. (1992) studied the eating behaviour of 11 year olds. The sample consisted of twenty three children of normal weight and twenty obese children (BMI range of 15 to 20 and 24 to 33 respectively). The children ate alone and their eating behaviour was measured using an eating monitor. This is a concealed balance connected to a computer which automatically records the amount of food taken from the plate. The computer analyses total food intake, and the duration and rate of food consumption. The results showed that although there was no statistical difference in the amount of food eaten between groups, the overweight children ate faster and did not slow down their rate of eating towards the end of the meal as much as the normal weight children. This study employed the method of observing the child while they were eating in an isolated environment which is unlikely to capture eating behaviour as it usually occurs in everyday situations.

Marston et al. (1976) observed eight pairs of children, four in the 6-8 year range, three in the 9-11 year range and one in the 12-14 year range. They were matched for age and sex and were assigned to the category of fat or thin on the basis of observer judgement. The children were observed in their school cafeteria while eating a full school hot lunch. Two separate samples of eating were recorded: the first comprised five bites during which responses such as 'hesitates before bite', 'picks at food' and 'wipes mouth with napkin' were recorded; the second comprised a three minute period during which the frequency of bites and chews per bite and the estimated bite size on a 5-point scale were recorded. Data were also collected on whether any food had been left at the end of the meal, although the authors do not report on the results of this part of the data collection. The obese children were found to have a faster bite rate and chewed each mouthful less than the non-obese children.

Nakao et al. (1990) obtained anthropometric measurements of a sample of eleven normal weight pre-school Japanese children using weight as a continuous variable. The children were observed eating in a group at their nursery for eighteen consecutive days at three times during three consecutive years. The mean ages at the first observation was 40 months, at the second 52 months and at the final observation, 59 months of age. A behaviour sampling coding scheme was used: one action per minute was recorded per child until each child had finished eating. Nakao et al. found no relationship between eating behaviour and weight at 40 months when the children were not consistently self-feeding; eating behaviour at this age was influenced more by familial factors and growth history than by weight. For the observations at 52 and 59 months, however, meal duration was significantly negatively related to weight and BMI. This study was conducted on Japanese children learning to feed themselves using chopsticks and the results may not be generalisable to the eating behaviour of other children.

Israel et al. (1985) also used body weight as a continuous variable when studying its relationship with eating behaviour. The child's percentage overweight for height, age and sex was calculated from height and weight measurements of 60 children aged 7-12 years. The sample comprised 40 normal weight children and 20 overweight children. Of these, 12 were between 15% and 30% overweight and 8 were more than 30% overweight. The children were observed during their lunch period in the school cafeteria, but were allowed to select their own choice of food. Behavioural observations were conducted using a similar behaviour coding scheme to that used by Drabman et al. (1979); 30 seconds observation followed by 30 seconds nonobservation for a maximum of ten times. Three summary variables were calculated: a count of bites per 30 second interval, a count of chews per bite, and interruptions (a summed count of instances of toying with food, pausing, talking and sipping). None of these aspects of eating behaviour was found to be consistently associated with weight. A possible explanation for this discrepancy between this and other studies is that Israel et al. (1985) did not require their subjects to eat a standardised meal while being observed but rather allowed food selection to vary between subjects.

In summary, some interesting relationships between child body weight and eating behaviour have been reported. The most consistent findings are that overweight children have a faster bite rate and a faster chewing rate and have shorter meals than children of normal weight. However, there are various ways in which research investigating this issue can be extended.

First, an important consideration in any field of research is knowing the probability that an investigation will achieve statistically significant results if the alternative hypothesis is true, i.e. its power (Cohen, 1992). Whilst acknowledging the fact that observational work is very time consuming, it is important to note that the sample sizes in several of these studies are very small. For example, Nakao et al. (1990) report the results of a study based on a sample of eleven subjects. This investigation therefore had less than 80% power, two-tailed, to detect a very high correlation of 0.75, and only 50% power to detect a correlation of 0.60 at an α level of $p<0.05$. Put another way, there was a 50% chance of the investigation not detecting a true correlation of 0.60. The power of such work is unacceptably low. Although these researchers have found significant results despite their sample size, there is still the potential 'file drawer problem' in that published work is a biased sample of the studies that have actually been carried out (Rosenthal, 1991) - generally biased towards those showing positive results.

Second, different researchers have used different methods of obtaining weight data from their samples: some researchers use observer's estimates (e.g. Drabman et al., 1979; Marston et al., 1976) and others use anthropometric measurement (e.g. Barkeling et al., 1992; Israel et al., 1985). Using observers to judge weight status introduces a source of subjectivity into the data. Although reliability can be assessed, observer's judgements are almost bound to be inferior to actual measurements. Drabman et al. (1979), for example, obtained height and weight measurements for ten randomly selected subjects classified as overweight. They found that on average this subsample was above the 85th percentile of weight for height for sex on growth charts developed by the National Center for Health Statistics (1976). However, the range of the sample was from the 60th, which is only slightly above average for the population, to above the 95th percentile. Unfortunately, whichever way the weight data are obtained, observational research investigating body weight and eating behaviour at the same time-point has the unavoidable but serious problem of observer bias (i.e. the observer knows whether each subject is obese or non-obese).

Third, some researchers have dichotomised their sample into normal and overweight subjects, which introduces the problem of deciding where the cut-off point for the overweight category should be. Rather than dichotomising samples, other researchers have used weight status as a continuous variable (e.g. Nakao et al., 1990; Israel et al., 1985) which has the advantage of avoiding the problem of specifying cut-off points for the overweight category.

Fourth, with the exception of Barkeling et al. (1992), all the studies mentioned obtained their data using direct observation of the meal. This has implications for the way in which the data are coded; direct observation uses time-sampling procedures to allow time for coding. For example, the coder might observe for 10 seconds then record for 10 seconds. Results reported from time-sampling procedures by definition only describe a segment of eating behaviour from the whole meal.

Fifth, several of the studies do not report eating behaviour over entire eating meals but for a specified number of minutes (e.g. Drabman et al., 1979; Israel et al., 1985). For example, Drabman et al. continued coding for ten sample intervals of 30 seconds, so that a total of five minutes observation was obtained (unless the child finished eating before then). The problem with this procedure is that the duration of the meal is unknown, and the longer the unknown period is, the greater the proportion of behaviour not included in the estimates. It is preferable for the whole meal to be coded, so that the behavioural measures will not be biased in this way.

Sixth, two of the studies observed the children while they were eating alone and in a laboratory setting (Keane et al., 1981; Barkeling et al., 1992) which raises the issue of ecological validity. Other researchers have observed children in school cafeterias (e.g. Drabman et al., 1979) which has the advantage of being a more natural environment for the children than a laboratory. Research designs have to made compromises between precision and naturalness (Hill et al., 1995). Hill et al. claim that variables demonstrated to influence eating under experimental conditions probably do not cease to operate in other conditions but do become more difficult to detect. Designing a study in a more natural environment would therefore necessitate selecting a large sample to ensure that power is sufficiently high to increase the chances of detecting real effects.

Other aspects of children's eating behaviour

There are a number of other important aspects of children's own eating behaviour which need to be borne in mind. For example, Birch (1979a; 1979b; 1980) designed studies to determine which factors affect food preferences in 3-4 year olds. The two dimensions which together consistently accounted for 50-60% of the variance in food preference (in approximately equal proportions) were sweetness and familiarity. One distinction between these two dimensions is that sweetness is an intrinsic characteristic of a food whereas familiarity depends on exposure. Each will be considered separately.

As regards the first dimension, humans seem to have an innate preference for sweet foods (Rolls and Shide, 1992). This has been shown in different types of studies of infants in which facial expressions, sucking rates and the quantity of a solution consumed are interpreted as indicators of their preferences. Lipsitt (1977) showed that infants change their facial expression in response to the four basic tastes of sweet, salt, sour and bitter. For example, bitter stimuli were associated with a wry facial reaction characterised by tightly shut eyes, convulsive throat contractions, a wide opening of the mouth and ejection of the stimuli along with mucus, whereas sweet stimuli were associated with the opposite reaction and a tendency to suck. Studies with newborns show that different concentrations of sucrose solution are associated with sucking rates: the more concentrated the sucrose solution the greater the number of sucks (Crook, 1977). Furthermore, briefly introducing intra-oral fluid during non-nutritive sucking changes the sucking rhythm; relative to distilled water, sucrose solutions tends to lead to longer sucking bursts while salt solutions lead to shorter bursts (Crook, 1978). Desor et al. (1973) investigated the quantity of solution ingested by newborn infants. The infants were offered plain water and four different sugar solutions in different concentrations: sucrose, fructose, glucose and lactose. The results showed that more of the sugar solutions were consumed than water, and the greater the concentration of sugar, the more the intake of solution increased.

According to Cowart (1981), there is evidence that the innate preferences for sucrose remain constant throughout early childhood. For example, Desor et al. (1977) showed that infants from 5-6 months ingested more of a solution as its level of sweetness increases, and Filer (1978) that 2-6 year old children ate significantly more sweetened than unsweetened spaghetti.

The second dimension identified by Birch as an influence on the food preferences and food intake of young children was familiarity. One way in which this has been studied is by using initially novel foods and introducing them to young children on varying numbers of occasions and obtaining preference data before and after consumption. During one study (Birch and Marlin, 1982) children received 20, 15, 10, 5, 2 (or 0) exposures to five initially novel foods during a familiarisation procedure which lasted twenty six days; one pair of foods was presented per day. After the familiarisation trials children were given ten choice trials comprising all possible pairs of the five foods. The results showed that children's preferences were highly correlated with the frequency of exposure; all but one of the fourteen children consistently chose the foods that they had become more familiar with over the course of the study.

Harris and Booth (1987) studied food familiarity in one-year-olds divided into two groups according to whether they frequently or infrequently ate unsalted potato. All the infants were offered the two versions of mashed potato, one salted (100mg NaCl/100g potato) and the other with no added salt. The children who frequently ate potato consumed more of the unsalted version of potato, while those who infrequently ate potato consumed more of the salted version. This experiment showed that the children who were familiar with potato preferred the flavour with which they were most familiar.

There is evidence that children's eating behaviour is affected by a regulatory mechanism known as sensory specific satiety. This describes a decreased short-term motivation to eat a food which has recently been ingested compared to the motivation to eat a food which has not recently been ingested. Birch and Deysher (1986) investigated sensory specific satiety by obtaining preference data immediately before and after a preload, and again twenty minutes later. They found that children's preferences for different foods declined for the foods eaten relative to those not eaten. The drop in preference was only statistically significant at the preference assessment immediately following food ingestion, and not a subsequent assessment held twenty minutes afterwards. Food acceptability alters, then, temporarily as a result of food ingestion, and is specific to the foods consumed. It follows from this that increasing the variety of foods at a meal will increase food intake, and certainly in adults this has been shown to be the case. Pliner et al. (1980) investigated this in a sample of 103 male subjects. They were presented with a meal consisting of either a variety of foods or a single food. The results showed that subjects ate more when presented with a variety of foods. Furthermore, they showed that the palatability of a food decreased with the amount consumed of that particular food. Similarly, Rolls et al. (1982) showed that subjects would consume more sandwiches if the fillings were repeatedly changed.

There is evidence that the variability in total daily energy intake varies according to the developmental stage of the child. Black et al. (1983) examined developmental changes in day-to-day variation of energy intake in two groups of 2-18 month old initially breastfed infants. Four-day weighed intake records were kept at monthly intervals until the infant was 7½ months in one group, and to 18 months in the other. While the infants were still fully breastfed, day-to-day variation in energy was relatively low (mean within-subject coefficient of variation 10.6): as infants were weaned it rose slightly and by 15-18 months it had increased considerably (mean within-subject coefficient of variation 17.9). It was concluded that day-to-day variation in energy intake is low when infants are predominately breastfed and increases as the proportion of other foods increase.

Birch et al. (1991) examined meal-to-meal variability of energy intake in fifteen 2-5 year olds. All the children were supplied with food by the research team, and food intake was recorded over 24 hours on six days - two days per week for three consecutive weeks. The researchers reported high variability in energy intake from meal-to-meal (mean within-subject coefficient of variation 33.6), but much lower day-to-day variability (mean within-subject coefficient of variation 10.4). One possible explanation for the finding that day-to-day variation was lower than in Black et al.'s (1983) study, is that there is yet another developmental change in day-to-day energy in that it decreases again by the age of 2-5 years. Birch et al.'s methodology provides very precise estimates of energy intake, but does not allow the children to eat snacks or to choose foods other than those on the protocol menus. Put simply, the study design does not reflect the huge variation in food available in everyday life.

Shea et al. (1992), however, investigated variability of energy intake in young children in their everyday environment. The mothers of a sample of 181 pre-school children were asked to provide 24 hour dietary recalls on seven occasions over two years. The children were aged 45-60 months at the time of the first dietary recall. Energy consumption was calculated from the recalled foods and portion sizes. Each day was broken into six eating occasions and all the foods from each period were summed. Coefficients of variation for energy consumption at the six eating occasions ranged from 46.5 to 165.8, but day-to-day variation was much lower (mean within-subject coefficient of variation 30.3). Although this was much higher than the day-to-day variation reported by Birch et al. (1991), it was significantly less than would be expected if energy intake was not being controlled and the authors concluded that children who ate less at one meal, compensated by eating more at the next. Shea et al. suggest that the difference in day-to-day variation compared to Birch et al.'s study is partly due to the larger measurement error in estimating energy intake from 24-hour recall, and partly to the greater true variation in energy consumption in the children's everyday environment compared to the constraints of an experimental protocol. It can be concluded that in obtaining estimates of energy intake, it is important that measures are taken from meals over at least 24 hours to take into account variations in meal-to-meal energy intake.

There are developmental differences in young children's eating behaviour which depend on both the child's stage of maturation and experience with solid foods. From the age of about 9-18 months, some infants may be spoon fed by the mother while others may be predominately self feeding. In a study of the development of spoon-using skills in 1-2 year olds, Connolly and Dalgleish (1989) reported that although the developmental sequence of specific self feeding abilities followed a similar course in all infants, they appeared at different times in different individuals.

It has been shown that food texture influences eating behaviour. Gisel (1991) investigated chewing behaviour in children in six age groups (6, 8, 10, 12, 18 and 24 months) by presenting them with standard foods of purëed, viscous and solid textures. The children's eating behaviour was video recorded and examined for time taken to swallow the food on being placed in the infant's mouth and the number of chews taken for each presentation of food. The time taken to swallow foods was significantly different for foods of different textures. It took children the least time to swallow purëed foods, longer for foods of viscous texture, and longer again to swallow foods of solid texture.

It is surprising how little is known about how long children's ordinary meals actually last. Normative data on feeding times have potentially important applications: for example, the information could be used to compare the eating behaviours of control groups of children with clinical groups, such as those with failure-to-thrive or cerebral palsy. Reau et al. (1996) claim to have the first published data on the time it takes to feed infants and toddlers. They developed a self-report measure designed to investigate normal feeding times. Parents with infants aged 3-27 months participated, and were asked to state the duration of a typical meal. The median duration was 17.3 minutes at 3 to 5 months (n=40), 12.3 minutes at 5 to 7½ months (n=21), 19.0 minutes at 7½ to 10½ months (n=47), 18.5 minutes at 10½ to 13½ months (n=39), 17.4 minutes at 13½ to 16½ months (n=38) and 17.0 minutes at 16½ to 21 months (n=44). There were no statistically significant differences in mean feeding time across age groups. However, the authors themselves admit that the data are limited because of the sample size and the self-report nature of the data. Data collected from naturally occurring meals are needed in order to determine the normal duration of meals, rather than relying on retrospectively recalled data.

Conclusions and rationale for the study

Within months of birth, infants have to make the transition from a diet consisting exclusively of milk to a mixed diet. In doing so they have to learn both a completely different repertoire of skills in order to ingest food and learn about the physiological consequences of ingestion. Additionally, the child develops food preferences and food aversions, and learns to select appropriate foods, in appropriate combinations and eat them at appropriate times in accordance with their culture, and in quantities to meet nutritional needs (Birch, 1987). In all this the influence of the environment in which the child is surrounded is important.

Experimental work on eating behaviour has established that infants and young children are capable of controlling their own energy intake. The fact that adults do not demonstrate the same degree of accuracy in the control of energy intake as children suggests that the existence of this ability is upset at some stage. It has been argued that individual differences in styles of intake control in adulthood emerge during childhood partially as a result of differences in early experience with food and eating (Birch, 1993). Birch suggests that children rely more on physiological cues of hunger and satiety to control their appetite, whereas adults have learned to rely more on external cues such as the timing of meals and how appetising the food looks (Birch and Deysher, 1986). In an attempt to ensure that children eat an adequate diet, parents sometimes use feeding strategies to try to increase their child's food consumption. Studies have shown that such strategies are counterproductive (Birch et al., 1980; Birch et al., 1984). Conversely, it has been shown that simply giving the child some attention during feeding episodes is sufficient to enhance preferences for that food and others of the same category (Birch, 1981).

There is also evidence that mothers' child feeding practices are related to children's ability to calorie compensate (Johnson and Birch, 1994). In addition, parents who report high levels of disinhibition have children with less ability to calorie compensate. The same study showed that girls, but not boys, with mothers reporting high levels of restraint showed less evidence of the ability to calorie compensate, raising the possibility that girls and boys are treated differently at mealtimes.

Birch's body of experimental research has successfully quantified children's energy intake under certain conditions and established some of the influences on food intake. However, these studies do not measure the process of the meal, the mother's child feeding practices, or the child's actual eating behaviour as it takes place. Observational methodology is needed to address these aspects of eating behaviour. In view of the evidence for a rising prevalence of childhood overweight (Troiano and Flegel, 1998) and childhood obesity (Gortmaker et al., 1987), it is important for studies to identify environmental factors which prompt its development in the very early stages to assist the development of preventative measures and effective intervention treatments.

Johnson and Birch (1994) showed that the group of children showing the least ability to calorie compensate had significantly higher skinfold measurements than the group showing the most ability. Related to this is evidence of associations between child body weight and observed eating behaviour. Two of the most consistent findings are that overweight children have shorter meals and a faster bite rate that normal weight children (e.g. Keane et al., 1981; Nakao et al., 1990). Various problems have been associated with previous studies. In particular, the researchers have tended to select small samples which has implications for the statistical power of the studies. Also, time-sampling procedures have usually been employed (for example, observing for 10 seconds and recording for 10 seconds), and sometimes only a specified number of minutes of the meals have been observed. It is important that the issue of body weight and eating behaviour in children is investigated using larger samples, and that total feeding episodes are observed to provide reliable estimates concerning the eating behaviour that takes place.

To date, not much is known about the actual feeding behaviour of children during the weaning stage of late infancy. This may reflect the particular difficulties of this area of research. Whereas young infants feed on one type of food only, older infants eat a varied diet; and whereas children of school age feed autonomously, younger infants need help in varying degrees depending on their stage of development. Immediately the complex nature of this field of research can be seen: not only are there many combinations of foods that the children can be given to eat, but there is also always more than one person involved in the feeding process.

This study aimed to obtain data concerning the feeding behaviour of children who had reliably been introduced to solids feeding, but were at a stage close to the onset of weaning when the child is still dependent on their mother at mealtimes. This is the beginning of the period over which maternal influence on adult-type feeding behaviour can occur, and as such it is potentially important in the transmission of feeding characteristics across generations.

The Weaning and the Weaning Diet Report (Department of Health, 1994) recommend 'a mixed diet should be offered by six months'. The Infant Feeding Report (Foster et al., 1997) present data on the age at which solid foods are actually introduced to infants in Great Britain: 55% had been introduced to solids by three months, 91% by four months, 99% by six months and 100% by nine months. The Infant Feeding Report (Foster at al., 1997) also recommends 'that by one year children's diets should be mixed and varied'. Nutritional weaning often is complete by one year, but this age is still a transitional stage as regards feeding *behaviour.* Before gaining independence from the mother, the child still requires varying degrees of help according to prior exposure to and experience with solids, and their own particular stage of development. One of the suggestions of the thesis is that there are two important aspects to consider in the study of weaning: not only the nutritional aspect, on which there has been a great deal of previous research, but also the behavioural aspect, on which there has not.

This study, therefore, has five main purposes. The first is to describe children's eating behaviour in late infancy and analyse the interaction that takes place between mother and child during mealtimes. The second is to investigate relationships between the mother's child feeding practices and the child's observed eating behaviour. The third is to investigate the mother's self-reported eating characteristics, and relate them to her observed child feeding practices. The fourth is to investigate whether there are any sex differences in eating behaviour, and whether boys and girls are treated differently during meals. The fifth is to investigate whether children's eating behaviour is associated with their body weight, and whether eating behaviour predicts gain in weight.

Chapter Two

Preliminary study on Three-Factor Eating Questionnaire

Introduction

Johnson and Birch (1994) investigated self-reported parental eating characteristics using the Three-Factor Eating Questionnaire (TFEQ). The TFEQ assesses a person's perception of his or her own eating behaviour, and it consists of three scales: cognitive restraint measuring the extent to which a person believes they exercise cognitive control in regulating their own food intake, dietary disinhibition which measures how difficult it is for a person to stop eating once they have begun, and hunger which measures susceptibility to hunger. Johnson and Birch's results showed that mothers' dietary restraint was negatively correlated with girls' COMPX although the result just missed statistical significance (r=–0.37, p<0.08). The authors suggest that this provides some support for their hypothesis that mothers who cognitively control their own intake may be especially controlling in their child feeding practices, resulting in girls who are less able to calorie compensate. There was a statistically significant positive correlation between boys' COMPX and mothers dietary restraint (r=0.41, p<0.05). When the scores of fathers and mothers were computed together, there was a statistically significant negative correlation between disinhibition and child COMPX (r=–0.35, p<0.02). In other words, parents who reported difficulty in controlling their own eating had children who failed to adjust their intake in response to the energy density of food.

The work reported in the thesis aimed to find out whether a mother's self-reported eating characteristics are related to the way in which she feeds her child, and to investigate whether there are sex differences in the way children are treated during meals. It was planned to use the TFEQ to measure dietary restraint and disinhibition because Johnson and Birch's (1994) results are based on this questionnaire.

The TFEQ has been shown to be psychometrically sound by several studies which report its reliability and validity. According to an unpublished manuscript by Ganley cited by Stunkard and Messick (1985), the one-month test-retest reliability (Pearson's *r*) of the TFEQ is 0.93 for the restraint scale, 0.80 for disinhibition, and 0.83 for the hunger scale. Allison et al. (1992) tested the TFEQ on 901 undergraduates and retested a subset of 34 subjects two weeks later. They analysed the data from the restraint scale and reported that test-retest reliability was 0.91 and internal consistency (Chronbach's α) was moderately high at $\alpha=0.90$.

As part of a wider study, Laessle et al. (1989a) investigated the construct validity of the German version of the TFEQ. They studied this by relating the restraint scale to the self-reported mean energy intake per day in a sample of sixty normal weight German women aged between 18-26 years. Exclusion criteria were vegetarianism, a history of clinical eating disorders or having lost more than 4 kg during the previous four weeks of the study. Subjects kept a seven-day food diary from which actual daily energy intake was estimated using a computer program. The results showed that there was a statistically significant negative correlation between restraint and mean daily energy intake ($r=-0.46$), and the authors concluded that high scores on the TFEQ restraint scale were related to successful dieting behaviour.

Laessle et al. (1989b) analysed the same data to investigate everyday eating behaviour in restrained and unrestrained eaters. They used a median split to classify the sample into restrained and unrestrained groups and compared their to total energy intake. Restrained eaters reported consumption of around 400 kcal less than unrestrained eaters (means of 1956 kcal and 2338 kcal respectively). A statistically significant negative correlation was found between restraint score and daily energy intake (r=–0.45). The authors concluded that psychometrically classified restrained eaters do restrict their food intake in ordinary life although not to an abnormally low level.

Tuschl et al. (1990a) established the face validity of the restraint scale of the TFEQ by using it to test a large sample of young normal females. The data from those scoring within the lower (n=19) and upper (n=20) quartiles were analysed. A standardised questionnaire assessed food choice frequency; seven categories of ratings from "never" to "several times per day" over the previous three months were provided. Restrained and unrestrained eaters did not differ significantly in reported food choice frequencies for basic foods. However, restrained eaters showed a strong tendency to avoid fat, and a large percentage of restrained eaters consumed artificial sweeteners and others calorie-reduced foodstuffs.

The three studies mentioned above (i.e. Laessle et al., 1989a; Laessle et al., 1989b; Tuschl et al., 1990a) suggest that cognitive restraint is related to lower levels of self-reported energy intake and consumption of reduced-energy foods. Although Laessle (1989b) reported that the high restraint group ate around 400 kcal a day less than the low restraint group, they also reported that the restrained eaters had a slightly higher mean body mass index (BMI) than unrestrained eaters. One possible explanation for this finding is the nature of self-reported data; restrained eaters may systematically under-report their food intake. An alternative explanation is that restrained eaters have a lower level of energy expenditure than unrestrained eaters. Tuschl et al. (1990b) conducted a study to determine which of these two explanations explained groups of restrained individuals eating 400 kcal less than unrestrained eaters with a similar mean BMI. They investigated this using a sample of 23 normal weight women aged 18-30 years. Fifty subjects completed the TFEQ and those whose scores fell into the lower and upper quartile cut-offs of age and weight-matched healthy women who had previously completed the questionnaire were recruited to take part in the study. The final sample comprised twelve restrained and eleven unrestrained eaters. The average energy expenditure of the subjects was calculated using the doubly labelled water method which provides a reliable and non-intrusive determination of energy expenditure of free-living subjects. Subjects also completed a detailed food diary. Adjusted for body composition and height, the restrained group consumed approximately 410 kcal/day less than the unrestrained group. However, their energy expenditure was also lower by 620 kcal/day when similarly adjusted. The similarity in BMI across the groups, then, is explained by the fact that restrained eaters have lower energy expenditure than unrestrained eaters due to diminished energy requirements. There was no support for the view that restrained eaters under-report their food intake.

Finally, Allison et al. (1992) investigated the TFEQ's susceptibility to dissimulation (the degree to which respondents can misrepresent themselves in either a desirable or undesirable direction). The sample answered all the items on three questionnaires measuring restraint (TFEQ, Dutch Eating Behaviour Questionnaire or DEBQ, and the Restraint Scale or RS). Each subject was assigned to either a 'fake good' or 'fake bad' condition. Subjects in the fake good condition were instructed to answer in such a way as to create the most favourable impression possible, and those in the fake bad condition to answer so as to create the worst possible impression. It was shown that the restraint scale of the TFEQ was essentially unfakable compared to the restraint scale of the DEBQ which was affected by the intent to deceive although not significantly so, and to the RS which was strongly significantly affected by the intention to dissimulate.

It can be concluded that the TFEQ has been shown to be psychometrically sound. However, several inconsistencies in relationships between the subscales, and between the subscales and BMI have been reported in non-clinical samples. For example, Laessle et al. (1989a) recruited 60 young women (56 college students and 4 employees) and divided them into a restrained and unrestrained group using the TFEQ and a median split. It was found that the restrained group had a slightly higher mean BMI than the unrestrained group. Tuschl et al. (1990b) examined this relationship using the scores representing the cutoffs of the lower and upper quartiles for restraint in a sample of 23 women recruited from universities. They found that restrained eaters had significantly higher BMIs than unrestrained eaters in a sample of normal weight young women. Similarly, Hill et al. (1991) tested a sample of 206 women made up of 38% students and a wide range of university and hospital staff. Hill et al. reported a positive correlation between the restraint scale of the TFEQ and BMI.

Williamson et al. (1995) recruited 293 women recruited from a community and university population. Each subject completed the TFEQ and the results showed that, contrary to the findings of Laessle et al. (1989a), Tuschl et al. (1990b) and Hill et al. (1991), restraint was negatively correlated with BMI. Johnson and Birch (1994) recruited women who used a child nursery serving a university and community, and reported that restraint and BMI were unrelated in their sample of mothers. It can be concluded that the findings on the relationship between restraint and BMI in non-clinical samples are inconsistent.

Evidence about the relationship between restraint and disinhibition in non-clinical samples is also somewhat inconsistent. For example, Lawson et al. (1995) studied BMI, restraint and disinhibition in a sample of 523 woman recruited by the media in the community and on a university campus, in a way designed to attract a sample of women heterogeneous in body weight and self-reported eating characteristics. All subjects completed the TFEQ, and a sample of 206 subjects were included on the basis of scoring either below the 30th or above the 70th percentiles on the restraint and disinhibition scales. In order to create a sample who were extreme on both scales, 48 subjects were selected (high restraint/high disinhibition, high restraint/low disinhibition, low restraint/high disinhibition, low disinhibition/low restraint). The results showed that restraint and disinhibition were uncorrelated. Similarly, Williamson et al. (1995) reported no relationship between restraint and disinhibition. However, Hill et al. (1991) reported a positive correlation between restraint and disinhibition. Hill et al. also reported a positive correlation between disinhibition and BMI and a positive correlation between disinhibition and hunger.

Rationale for the preliminary study

A preliminary study using the TFEQ was conducted so that the most appropriate sampling procedure could be determined for the main study. It was important to check that the distributions of scores for the restraint and disinhibition scales included a wide range of scores. Many studies analyse data for groups dichotomised, for example, into high and low restrained eaters based on the median score (e.g. Laessle et al., 1989a; Lawson et al., 1995). However, using a median split for a sample that turn out to be largely unrestrained, for example, would not help answer the question of whether unrestrained mothers feed their children differently from restrained ones. If the distribution of scores was not likely to be wide, it would be important to select groups of subjects according to whether they were high or low on the dietary restraint scale, and high or low on the disinhibition scale. The disadvantages of such a sampling procedure would be that it would be harder to recruit sufficient subjects according to the criteria, and the data on meals would be less representative. On the other hand, if a wide range of scores were obtained, this would provide good grounds for employing an unrestricted sampling procedure making recruitment of sufficient subjects easier, and providing more representative data on meals.

The preliminary study was conducted, then, to check whether any mother with a child of the appropriate age from the whole population of females could be included in the sample, or whether it would be necessary to select subjects on the basis of high or low restraint scores, and high or low disinhibition scores. The study was conducted on an opportunity sample of females of child-bearing age. Previous studies have reported contradictory relationships between the variables restraint, disinhibition and BMI. However, the studies cited all selected samples from college and university populations to a large extent. The preliminary study provided an opportunity to investigate these relationships further, and in a wider cross-section of the female population than previously.

Procedure

Two local leisure centres were asked for permission to approach their clients with the purpose of recruiting them as participants in a questionnaire survey. The proposed procedure was discussed and it was explained that the survey involved females of different ages completing the TFEQ, and some more general questions. The general questions requested information about the participant's date of birth and self-reported height and weight measurements. The participant's date of birth was necessary to calculate their age on the day of taking part in the study. In adults, self-reported height and weight have been shown to be highly correlated with measured weight and height (Kuskowska-Wolk et al., 1989; Lass et al., 1982). They were used to estimate the extent of individuals' overweight using the weight to height ratio of body mass index (BMI) calculated as weight divided by height squared (Bray et al., 1998). The BMI has been shown to be more highly correlated with body fat than with other indices of height and weight (Benn, 1971). Both leisure centres agreed to this request. Although it is possible that using such venues biases the sample to some extent, leisure centres are used by people of all different ages for many different purposes so it was anticipated that a wide cross section of females would be included in the survey. The aim was to recruit 150 females between the ages of 15 and 39 years in five age bands; 15-19 years, 20-24 years, 25-29 years, 30-34 years and 35-39 years.

The women were approached in three main areas within the leisure centres. The first was in the soft play areas; generally, it is women with young children who visit these and so tend to be within the age range being targeted. The second was in areas such as the trampolining hall which tend to appeal to teenagers. The third was in cafeterias and other sitting areas which were frequented by a wider age range of people.

When approached, potential participants were asked if they would take part in a study. It was explained that it involved completing a questionnaire on their eating behaviour and some general questions, and would take ten to fifteen minutes of their time. Almost without exception, those approached agreed to participate in the study. The researcher waited nearby while the questionnaires were completed and was available to help with any queries as necessary. Quota sampling was used: as soon as there was a total of thirty participants within each age band, data collection stopped for that age band.

Results

Figures 2.1, 2.2 and 2.3 show the distribution of scores for the subscales of restraint, disinhibition and hunger measured by the TFEQ. The figures show there is a high degree of variability in the distribution of scores for the restraint, disinhibition and hunger factors for the preliminary sample taken as a whole. Each distribution is positively skewed (i.e. the scores are slightly clustered at the lower end of the scale).

In order to examine whether the sample varied on the restraint, disinhibition and hunger subscales of the TFEQ according to age, the results were considered in the age bands in which the data were collected. Table 2.1 shows the descriptive statistics for the distributions of the scores from the subscales of the TFEQ for each age band. The table shows that the percentiles, means and standard deviations are very similar across age bands for restraint, disinhibition and hunger.

Figure 2.1 Histogram showing the distribution of scores for restraint for the preliminary sample

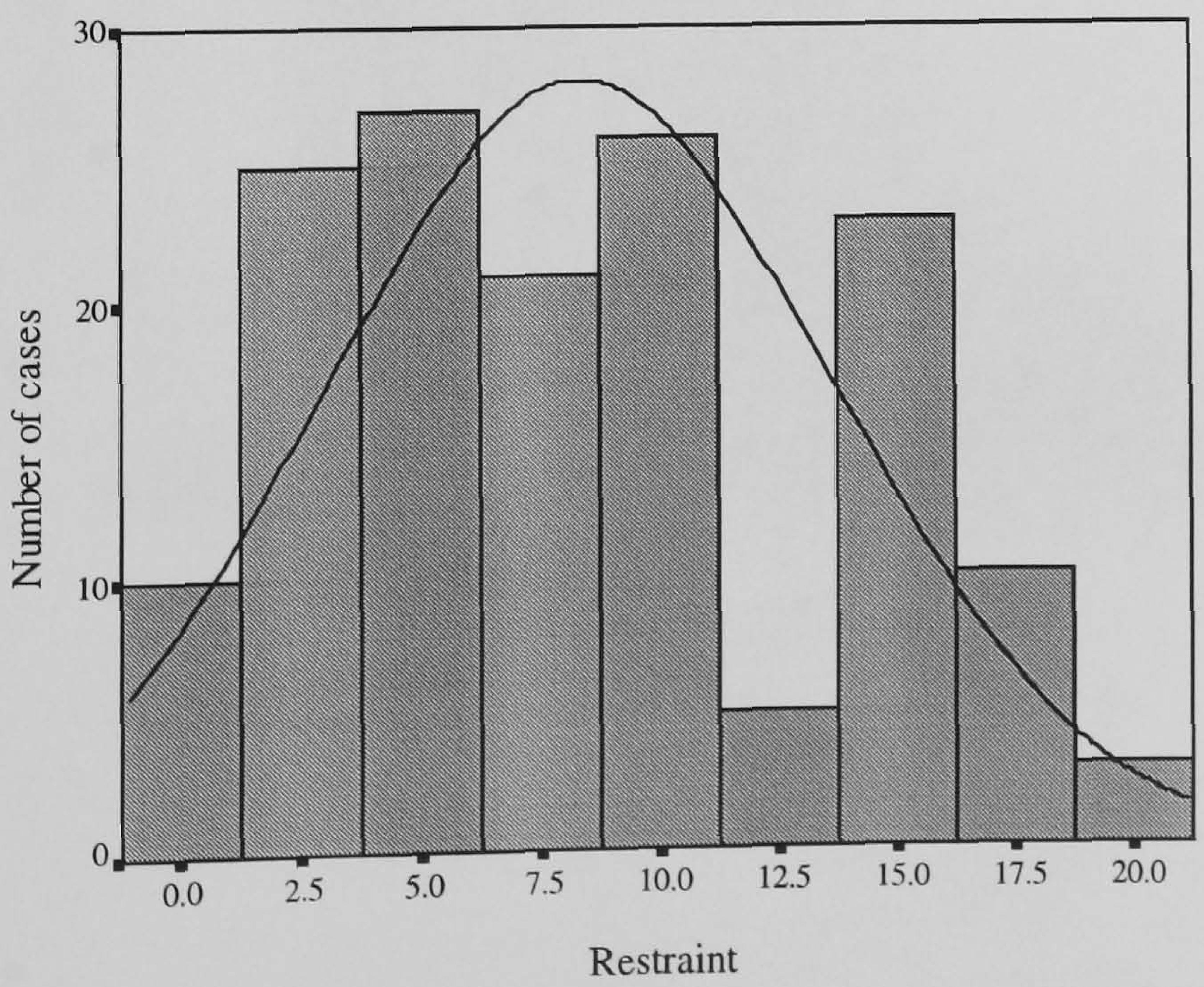


Figure 2.2 Histogram showing the distribution of scores for disinhibition for the preliminary sample

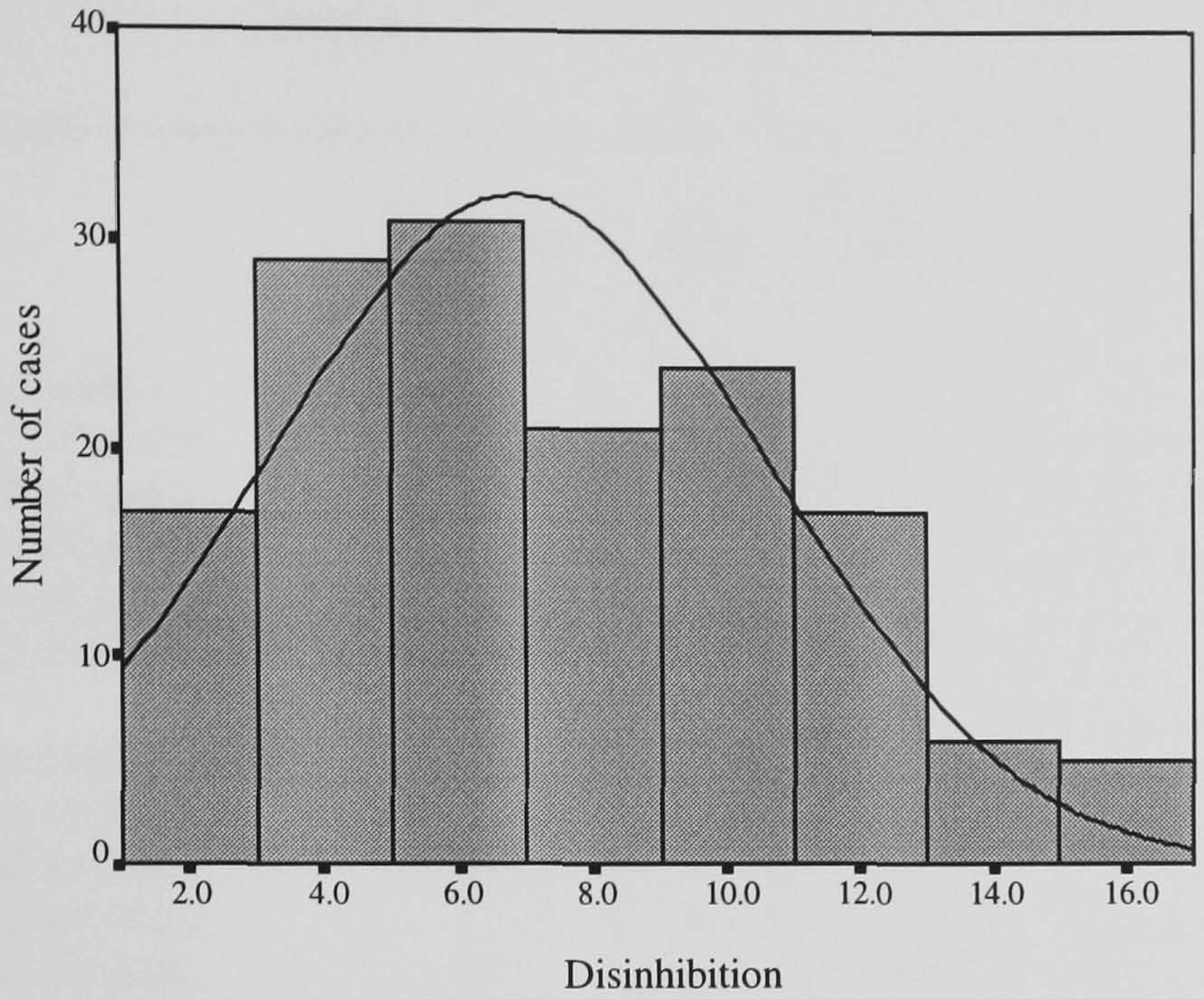


Figure 2.3 Histogram showing the distribution of scores for hunger for the preliminary sample

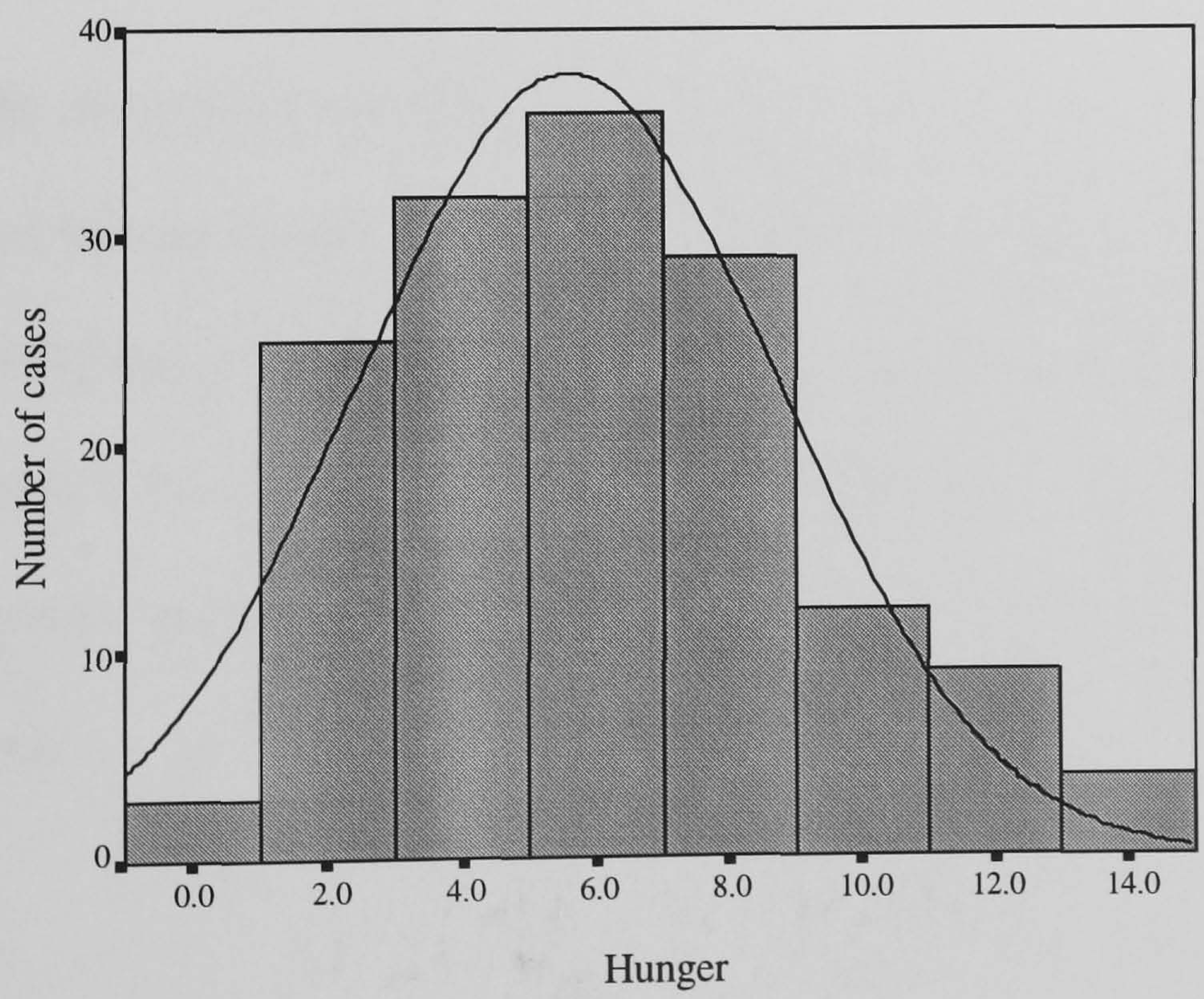


Table 2.1 Percentiles and other descriptive statistics for the restraint, disinhibition and hunger scores for each age band for the preliminary sample (n=30 for each)

	Minimum	25th	Median	75th	Maximum	Mean	SD
Restraint							
15-19 years	0.0	3.0	8.0	9.0	18.0	7.17	4.88
20-24 years	2.0	5.0	7.5	11.0	21.0	8.77	5.05
25-29 years	0.0	3.0	7.5	14.0	19.0	8.80	6.08
30-34 years	0.0	4.0	8.5	15.0	19.0	8.93	5.97
35-39 years	1.0	4.0	8.0	11.0	17.0	8.07	4.58
Disinhibition							
15-19 years	1.0	4.0	6.0	8.0	15.0	6.40	2.74
20-24 years	2.0	3.0	7.5	10.0	16.0	7.60	4.25
25-29 years	1.0	3.0	6.0	9.0	14.0	6.20	3.33
30-34 years	1.0	5.0	9.0	11.0	16.0	8.00	3.81
35-39 years	1.0	3.0	5.5	10.0	14.0	6.23	4.06
Hunger							
15-19 years	0.0	3.0	4.0	7.0	12.0	5.10	3.17
20-24 years	1.0	3.0	5.5	9.0	14.0	6.30	3.75
25-29 years	1.0	3.0	5.0	7.0	10.0	5.20	2.70
30-34 years	0.0	5.0	6.0	8.0	13.0	6.20	3.02
35-39 years	1.0	3.0	5.0	7.0	14.0	5.20	3.00

The descriptive statistics for the distributions of the scores for restraint, disinhibition and hunger for the preliminary sample as a whole can be seen in Table 2.2. The TFEQ has 21 items for restraint, 16 items for disinhibition and 14 items for hunger. Table 2.2 shows that each subscale had participants who scored the lowest and highest possible scores, with the exception that no participant scored zero on the disinhibition scale.

Table 2.2 Percentiles and other descriptive statistics for the restraint, disinhibition and hunger scores for the preliminary sample (n=150)

	Minimum	25th	Median	75th	Maximum	Mean	SD
Restraint	0.0	4.0	8.0	13.0	21.0	8.35	5.31
Disinhibition	1.0	4.0	6.0	9.0	16.0	6.89	3.70
Hunger	0.0	3.0	5.0	8.0	14.0	5.60	3.15

Table 2.3 shows the descriptive statistics for the BMI of participants for each age band separately and for the preliminary sample as a whole. The percentiles, means and standard deviations were similar across age bands for BMI, with the exception that the scores for the youngest age band were lower than for the other groups. This reflects the that fact that some participants within this age band are still going through stages of development.

Table 2.3 Percentiles and other descriptive statistics for BMI for each age band (n=30 for each) and whole preliminary sample (n=150)

	Minimum	25th	Median	75th	Maximum	Mean	SD
BMI							
15-19 years	15.62	19.99	20.74	21.91	30.36	21.31	3.02
20-24 years	17.38	20.81	22.50	24.64	37.48	23.53	4.30
25-29 years	17.09	20.75	22.42	24.09	31.72	22.70	3.23
30-34 years	18.20	21.57	22.85	25.78	40.33	23.92	4.22
35-39 years	18.59	20.59	22.70	25.46	39.42	23.47	4.27
BMI							
All (n=150)	15.62	20.58	22.12	24.50	40.33	22.99	3.91

In order to investigate the relationships between age, BMI, restraint, disinhibition and hunger further, age and BMI were computed as continuous variables. Because the distributions of the restraint, disinhibition and hunger subscales were only slightly skewed, Pearson's product moment correlation coefficients (*r*) were computed using the Statistical Package for the Social Sciences (SPSS). Pearson's *r* is a parametric measure describing a linear association between absolute values. Table 2.4 shows a summary of the results.

Table 2.4 Correlation coefficients (Pearson's *r*) between age, BMI, and restraint, disinhibition and hunger subscales for the preliminary sample

	BMI	**Restraint**	**Disinhibition**	**Hunger**
Age	0.14 NS	0.06 NS	0.00 NS	0.00 NS
BMI		0.22 p=0.007	0.03 NS	–0.17 p=0.039
Restraint			0.40 p<0.0005	–0.01 NS
Disinhibition				0.55 p<0.0005

Table 2.4 shows that age was uncorrelated with all the other variables. There were statistically significant relationships between BMI and restraint, and between BMI and hunger. There was a statistically significant correlation between the two subscales of restraint and disinhibition, and also between the subscales of disinhibition and hunger.

Discussion

The preliminary study was conducted to determine whether a wide range of scores on the subscales would be obtained in selecting a sample of ordinary women of child-bearing age. For the group as a whole, the restraint, disinhibition and hunger subscales differentiated between participants; there were scores at both extremes of all three scales, with the exception that no participant scored zero for disinhibition. The sample for the main study was to be mothers within the same age range, and from the same geographical region. On the basis of the results from this preliminary study, there were no grounds to select participants for the main study on the basis of their restraint and disinhibition scores on the TFEQ.

The intercorrelations between the subscales and BMI were also examined. There was a positive correlation between restraint and BMI which provides supporting evidence for other researchers investigating non-clinical samples (Laessle et al., 1989a; Tuschl et al., 1990b; Hill et al., 1991) who report that females with higher BMIs are more restrained than females with lower BMIs.

There was also a positive correlation between restraint and disinhibition, and between hunger and disinhibition, both of which support Hill et al.'s (1991) findings. Two other researchers have reported that restraint and disinhibition are uncorrelated (Lawson et al., 1995; Williamson et al., 1995). The preliminary study found a negative correlation between BMI and hunger which has not been reported by any of the studies cited in this section of the thesis (i.e. Hill et al., 1991; Johnson and Birch, 1994; Laessle et al., 1989a; Lawson et al., 1995; Tuschl et al., 1990b; Williamson et al., 1995).

Of the six studies mentioned immediately above, all were conducted primarily on females drawn mainly from colleges and universities. The preliminary study was conducted on an opportunity sample of women visiting leisure centres, and is likely to be more representative data on these characteristics of females than student populations. The results of this study, then, are more likely to be generalisable to the female population than previous research. In general, the findings of this preliminary study of the TFEQ are consistent with those of Hill et al. (1991) who also found a positive relationship between restraint and BMI, and between restraint and disinhibition, and between disinhibition and hunger. The other studies mentioned report their samples either as 100% (or almost 100%) students, or do not specify percentages. In cases where percentages are not stated, they are likely to be high because the samples were reported to be drawn from universities and the community. The only exception is Hill et al.'s (1991) study whose sample was only made up of only 38% students. For this reason, it is interesting to note that the pattern of intercorrelations from the preliminary study and Hill et al's study are very similar.

As well as being able to determine the most appropriate method of selecting a sample for the main study, the preliminary study has provided an opportunity to examine the relationships between the subscales of the TFEQ and BMI with a more representative sample of females than previous samples.

Chapter Three

Method

Aims of the study

To recapitulate, the aims of the study were:

1. To describe eating behaviour in late infancy, and analyse the interaction that takes place between mother and child during mealtimes.
2. To investigate relationships between the mothers' child feeding practices and their child's observed eating behaviour.
3. To investigate whether mothers' scores on the restraint or disinhibition subscales of the Three-Factor Eating Questionnaire are associated with their child feeding practices.
4. To investigate whether there are any sex differences in eating behaviour, and whether boys and girls are treated differently at mealtimes.
5. To investigate whether children's eating behaviour is associated with their body weight (or BMI) at the time of observation, and then prospectively at 18 months.

Design and measures

The project employed a quasi-naturalistic observational study of 12-14 month old children's mealtimes. The reasons for conducting the observations when the children were 12-14 months were two-fold. First, by 12 months solid feeding has reliably begun. Second, this age is a stage closely following the onset of weaning and as such may be an important time in establishing feeding habits.

A large sample of mother and child pairs was observed. In planning a study it is important to ensure that its statistical power is high enough to detect relationships which exist in the data. For example, to have >99% chance of detecting a correlation of 0.55 at $p<0.05$ level of significance, two-tailed, 50 subjects would need to be tested; to have the same chance of detecting a weaker correlation of 0.45, it would be necessary to test 80 subjects (Kraemer and Thiemann, 1987). From the above example it can be seen that the larger sample gives higher power; subtle effects are more likely to be detected with a larger sample. A sample of 100 participants gives >99% chance of detecting a correlation of 0.45, >95% chance of detecting a correlation of 0.36, >90% chance of detecting one of 0.32, and >60% chance of detecting even a very weak correlation of 0.22 (all at $p<0.05$ level of significance, two-tailed). In cases such as this where the effect sizes are unknown, it is especially important to begin with a design high in statistical power, so that the questions raised by the research can be adequately dealt with.

Observations were conducted within the child's own home, while the child was fed by its[A] mother. This ensured that the feeding behaviour being analysed reflected as near as possible the behaviour that usually occurred. Observing children within their own home is a very time-consuming method of collecting data: a great deal of time is spent travelling to and from the subjects' homes and if, for example, lunchtime meals are targeted, only one family per day can be observed. Nevertheless, if the aim is to study feeding behaviour as it usually occurs, this is necessary.

[A] The sample of children included boys and girls, and to avoid using just one of the pronouns 'he' or 'she', or the cumbersome use of both, the thesis uses the neuter pronouns 'its' and 'itself'.

Individual children's eating behaviour is likely to vary and in order to arrive at more reliable characterisations of eating behaviour, it was important to observe more than one meal per subject. Behaviour was therefore observed at two meals per subject, for the entire duration of the meals.

The mothers' self-reported eating characteristics were measured using the Three-Factor Eating Questionnaire. This particular questionnaire was chosen because the findings of Johnson and Birch (1994), the initial stimuli to the work in the thesis, were based on data from this questionnaire. The characteristics measured by the questionnaire were related to the way in which the mothers fed their child. The study took into account recent research which indicates that restraint and disinhibition are both important characteristics of the mother. In addition, the mothers also provided extra information about the child by completing a Child Feeding Questionnaire designed by the researcher. This dealt with aspects of the child's feeding history such as the method of feeding at birth, and when weaning began, which could be important factors in the child's eating behaviour at one year. Questions on the mothers' and fathers' education and employment history were also included in the questionnaire. The employment history was used to define the socio-economic status of parents using the Standard Occupation Classification (Office of Population Censuses and Survey (1990), so that the sample could be compared with a sample of the general population of households with young children (Thomas et al., 1994) and its representativeness assessed.

The study measured both the physical behaviour of the mother and child, and the mother's verbal comments to her child. In this way, it was possible to investigate relationships between the mothers' child feeding practices and their self-reported eating characteristics. Specifically, by observing both the verbal and non-verbal behaviour it was possible to identify whether there were any differences between mothers with particular eating characteristics in the things such mothers do when feeding their children, and any differences in what they say.

The mealtimes were observed using video recordings. Video recordings have three main advantages over direct observational methods. First, they allow for continuous coding so that all the feeding behaviour of the meal is represented in the sample of behaviour being analysed. Second, they allow for coding to take place at a later stage in an uninterrupted environment - it is far more likely that events such as visitors calling might disturb the concentration of the observer when it is carried out directly as the meal takes place. Third, video recordings make reliability studies possible. A further advantage of video recording mealtimes for this particular study was that the video tapes were available to transcribe the mother's verbal comments and it was possible to rewind the tapes as often as necessary to achieve accurate transcription.

Records of the type of foods and drinks offered during the meals and the amount of food served and food eaten in grams were kept. Energy intake was not determined as this requires each ingredient to be weighed separately. This would have imposed a considerable burden upon mothers which may have restricted the types of food offered to the child and the purpose of the study design was to keep the situation natural for the child. In any case, in view of the wide meal-to-meal variation reported in children (Birch et al., 1991; Shea et al., 1992), energy intake from two meals per child would not reflect each child's average energy intake accurately.

Anthropometric measurements of the parents and children were recorded so that characteristics of individuals could be compared according to estimates of their body fat content. There are several methods of estimating body fat content: laboratory methods include dual emission X-ray absorptiometers and deriving body density from underwater-weighing. The former is expensive and the latter is not especially easy to use (Bray et al., 1998). Methods which can be used outside the laboratory include height and weight, skinfold thicknesses and circumferences. All these methods are easy to use and inexpensive. However, height and weight is the most accurate method of the three in estimating body fat (Bray et al., 1998). Height and weight measurements were used for this study due to several advantages; the first was that mothers are familiar with the procedure of weighing children and would be unlikely to be concerned about a researcher weighing their child. The second was that it provided a method suitable for young children; weight is easy to measure in infancy and early childhood although length measurement does requires special training and is more time-consuming (Wright et al., 1994). The third advantage was that if both weight and height can be obtained they can be used together to provide a simple measure of fatness (Cole et al., 1995). A very flexible index of overweight is provided by the body mass index (BMI) calculated as weight divided by height squared. BMI has been used widely in adults as a simple summary measure of overweight (Garrow and Webster, 1985). Although adult BMI increases fairly slowly with age, in children it changes substantially with age and so needs to be assessed using age related reference curves (Cole et al., 1995). However, for this study the age of the children is within a narrow age band of two calendar months, making comparison of BMI across individual subjects appropriate.

The mother's and child's weight and height were measured at the time of the observations. As the study design only included the mother and child, it was anticipated that fathers would not necessarily be present at the time of the home visits, so it would not be possible to measure their height and weight. For this reason, the father's height and weight were recorded as reported by the mother. The study had a longitudinal element: the child's weight and length were recorded at the time of the behavioural observations and also prospectively by following the children up for weight and height measurements at 18 months. From this, it was possible to determine whether the eating behaviour of the children predicts weight gain.

The children's weights taken by midwives and health visitors subsequent to birth were recorded from parent-held records. Mothers with young infants often visit baby clinics during the child's early months for physical check-ups, vaccinations and advice from health visitors. These visits usually include the child's weight being measured and recorded in a book by a health visitor and kept by the mother. Because mothers attend baby clinics at their own discretion, there is wide variation in the number of visits they make; some mothers go every week or two, and others only if the child is due for a vaccination or if they are experiencing problems with the baby's feeding or sleeping, for example. One purpose of the routine measurements is that the child's weight gain can be monitored on growth charts. Growth charts illustrate reference standards derived from growth data compiled from populations of children of different age groups. The data are presented as centiles on separate centile charts for each sex. Separate charts are used for height for age and weight for age, and they each show centiles at selected intervals, including the extreme (e.g. third, fifth, ninety fifth and ninety seventh) and less extreme (e.g. twenty fifth, fiftieth and seventy fifth) centiles. Extreme growth patterns can be identified by entering measurements onto the charts at intervals and children whose growth pattern deviates from the norm can be referred. The children's weight records were collected to provide a record on the child's weight history over the first twelve months, which could be an important source of information.

Ethical Approval

Ethical approval is obligatory for all research involving patients of the National Health Service. Copies of the information sheet intended for participants, details of the procedure for recruiting participants, and the rationale of the research study, its design and measures were submitted to Gateshead Local Research Ethics Committee, Gateshead, Tyne & Wear. The study was approved subject to annual progress reports.

Training in the anthropometric measurement of children

In order to measure the equivalent of height in infants and children up to the age of two years old, it is necessary to use a procedure known as 'lengthing'. This involves lying the child on a flat board and holding his/her head firmly at one end while another person straightens the child's spine and legs down the board and takes a reading of the child's length. This procedure is a specialised task requiring training. Training was undertaken at the Royal Victory Infirmary, Newcastle upon Tyne in the Endocrinology Department over the course of several weeks. This training was followed up by arranging to practise lengthing babies during a baby clinic held at Elmfield Health Group, Gosforth, Newcastle upon Tyne under the supervision of Dr. Charlotte Wright, a Consultant Pediatrician.

Participants

The aim was to recruit up to 100 mothers with children aged between 12-14 months from within Gateshead, Tyne & Wear. Recruitment criteria specified that the children were all healthy singletons. The term 'healthy' was defined as having no chronic illness; children were not excluded on the basis of having relatively mild disorders such as asthma or eczema. In an attempt to maximise the chances of recruiting a representative sample, recruitment was carried out in an area of Gateshead with differing socio-demographic population characteristics. Three health centres were contacted in writing informing them of the intended research study and requesting use of their baby clinics to approach mothers with babies (Appendix One). A copy of the granted Ethical Approval was included. All three health centres agreed to this request.

Materials

The following equipment was used:

1. Video camera. A Panasonic Movie Camera (model NV-S70B) was used for all observations.
2. Food scales. A strain gauge electronic balance weighing to the accuracy of 0.1g (Ohaus CT series, model CT1200-S) was used for weighing foods.
3. Electronic digital scales (Seca model 835) suitable for weighing babies, toddlers and adults. The scales measure to the accuracy of 0.02g for babies and toddlers, and to the accuracy of 0.10g for adults.
4. Kiddimetre 'lengthing board' for measuring children's length to the accuracy of 1mm.

The following questionnaires and written records were used:

1. Information sheet (Appendix Two).
2. Consent form.
3. Three-Factor Eating Questionnaire (Stunkard and Messick, 1985) (Appendix Three).
4. Child Feeding Questionnaire designed for this study (Appendix Four).
5. Form for recording description of food served.
6. Form for recording weight of served and uneaten food.
7. Form for recording weights of child abstracted from parent-held records.
8. Form for recording weight and height of child at 12 months and mother and father.
9. Form for recording weight and height of child at 18 months.

Procedure

The initial approach for most participants took place at baby clinics. During frequent visits to these clinics, mothers with babies were approached and asked if they would take part in some research. At this stage the mothers were informed that the purpose of this study was to investigate children's feeding behaviour and the way in which children interact with their parents at mealtimes. They were told that the study involved completing two questionnaires and the video recording of two of the child's meals on one day in the child's own home. Mothers were reassured that the study did not require them to change their child's feeding routine in any way. If the mothers were willing to take part at this stage the further measures of weighing the child's food intake at the observed meals, weighing and lengthing the child and the follow-up eighteen month visit were explained. Any issues raised by mothers were discussed. In cases where the child had already reached the appropriate age, a visit to their own home was arranged. In cases where the child was under eleven months and the mother expressed an interest in taking part in the study, she was asked for some details (name, address, telephone number, child's name, child's date of birth) and told that she would be contacted when the child was eleven to twelve months old to make an appointment to visit her.

At the first visit the details of the study were discussed again, participants were given the opportunity to ask questions, and signed consent was sought. Participants were then asked to complete two questionnaires. The first, the Three-Factor Eating Questionnaire, was included to measure the mother's self-reported eating characteristics. The second was a Child Feeding Questionnaire designed by the researcher which dealt with the child's feeding history and some more general questions on the mothers' and fathers' education and employment history. Infant birth weight and any subsequent weights taken by midwives and health visitors were recorded from parent-held records.

Observations were undertaken in the participant's own home on a day convenient to the mother. In many cases, mothers have a routine feeding schedule by the time their child is a year old so that the time at which the lunchtime meal would take place could be predicted fairly accurately. To ensure that the researcher arrived in time to observe the feeds in cases where the time was not so easy to predict, mothers were given the option of being contacted by telephone on the observation day so that they could indicate the time they thought the meal would occur. Evening meal times were arranged after the lunchtime observation was completed. In all cases, mothers were given a contact telephone number so that they could change the arrangements as necessary. Mothers were asked to telephone the researcher on the morning of the observation day if they felt their child was showing signs of illness, and in cases where this occurred alternative arrangements were made.

The researcher arrived 10-15 minutes before the meal to set up the equipment. Mothers were asked to 'carry on as normal' and every effort was made to keep the environment as close to the child's usual feeding environment as possible. It was requested that the child should eat in their usual feeding position if possible and this was usually in a highchair. In the majority of cases no steps were taken that might alter the usual feeding environment, such as excluding visitors or turning off radios or television. In only a very few cases it was requested that radios and televisions were turned down slightly. It was hoped that this procedure would reduce disturbance to the meal to a minimum. The entire meal, including breaks between courses, was video recorded. Recording started when food was placed in front of the child and continued until either the mother removed any remaining food at the end of the meal, removed the child from the highchair or otherwise indicated that the child had finished eating. The mother made the decision to discontinue the feed.

Before the meal began, the serving bowls or plates containing the food being offered to the child at that meal were weighed. After the meal was over the bowls were weighed again with the leftover food in them, and once again when they had been washed and dried. From these measurements, the weight of food offered to the child and the weight of food consumed and left over by the child at that meal could be calculated. A description of the food and drinks offered to the child was also recorded. Arrangements were made for video recording the child's next meal, during which this procedure was repeated.

After lunch, the child's weight and (supine) length were measured. The child was weighed without any clothes or nappy on, and lengthed wearing a nappy and vest. The mother's height and weight were measured and these were recorded as well as the father's height and weight measurements as reported by the mother.

All participants were sent a written note of thanks for taking part in the study.

Participants were contacted again after the child had reached eighteen months. A follow-up visit was arranged during which the child was weighed and lengthed. The child wore a dry nappy and vest for both measurements.

A summary of the measures and timing of data collection points is given in Table 3.1.

Table 3.1 Summary of data collection points

Age of child	**Procedures**
0-14 months	Mothers were approached at Baby Clinic
12-14 months	Recruitment and consent form signed Three-Factor Eating Questionnaire Child Feeding Questionnaire Child weight history abstracted from parent-held records
12-14 months	Observations of lunch and evening meal Weighing of food offered to child during observed meals Weighing of food uneaten by child during observed meals Child's weight measurement Child's length measurement Mother's weight measurement Mother's height measurement Father's weight and height as reported by mother recorded
18-20 months	Child's weight measurement Child's length measurement

Blind status

In the study the same researcher collected the data and coded the video tapes for behaviour and the mother's verbal comments. In order to eliminate any possibility that the researcher was affected by knowledge of the mother's dietary restraint levels whilst collecting the data or coding the video tapes, it was important that these procedures were carried out 'blind'. To achieve this the questionnaires were sealed in envelopes on completion. They were kept confidential and scored at a later date by a research psychologist in the Psychology Department at the University of Durham (not the author).

Behavioural observations

The behavioural measures for this study were coded using a computerised program designed for this purpose called 'Minkey' (Marsh, 1988). While observing the meal on video, the codes relating to previously specified acts or other characteristics of the meal were entered in temporal order. An in-built timer recorded the time of onset for each coded act. The program was run separately for each individual meal being analysed and the information formed one file. Because the program only holds the information of the working file the information was written out and stored in a separate directory.

It was important that the inventory for coding mealtime behaviour was sophisticated enough to allow for the various features of eating behaviour which are particularly characteristic of young children. Because the child may feed itself or be fed by its mother, behavioural codes were needed for the mother's actions as well as those of the child. In addition, codes were needed to describe all the possible responses a child can make to offers of food from its mother, such as accepting or refusing it. At the onset of weaning infants are normally fed semi-solids such as baby rice using a spoon, and finger-feeding comes later with the introduction of solids proper such as toasted bread (Negayama, 1993). Similarly feeder-cups or drinking beakers are used while the transition from drinking from a bottle and using a cup takes place. Feeding, then, can be carried out not only by the mother or the child, but with or without a spoon and so on, and codes were needed to cover the different methods of feeding and drinking. Certain features about the food also require codes because the ease with which food is eaten in children aged up to two years partly depends on its texture (Gisel, 1991), and distinctions between savoury and sweet foodstuffs need to be made because children's acceptance of a particular food may depend on their preference for a particular taste. The additional information about the food and drinks also helped put the observed behaviour into context as it shows what the child was being fed when the behaviour in question was observed.

The Behavioural Coding Inventory used for this study was based on coding schemes described by two other groups of researchers in this field. The first was Agras et al. (1988). In this study the eating behaviour of parents and their 18 month old children was observed individually as they ate on separate occasions in a controlled laboratory environment. The index children were observed with their mother present but not eating to help create a more natural situation for the child. Subjects were provided with a standard buffet meal made up of a main course, salads, desserts and drinks. The behavioural measures used were bites of food (number and frequency), duration of chewing, duration of active feeding, and drinking (number of drinks and duration of drinking). The second group of researchers was Harris et al. (1991). They observed infants aged 16-25 weeks old being fed cereal by their parents. They analysed feeding behaviour and mode of acceptance of food using a coding system devised for spoon-fed infants aged from 3-12 months. The system included codes that described facial expressions, gaze, and head and body movements (e.g. positive or negative expression), and also codes that defined food acceptance behaviours (e.g. the infant opens its mouth before the spoon is proffered, or the infant refuses food when the spoon is proffered). Both studies established high rates of interobserver reliability of the behaviour codes used (*r* between 0.80 and 0.97).

The coding systems used by Agras et al. (1988) and Harris et al. (1991) formed the basis of the Behavioural Coding Inventory for this study. Because it was initially developed to study feeding related behaviour in children under the age of one year, it was revised and adapted for use with older children by other researchers from Durham University who have previously conducted studies on children's feeding behaviour (Young, 1997; Kasese-Hara, 1997). For this particular study, one extra code was added to describe the mother modelling food intake.

This revised Inventory includes codes which fall into the five categories: food substance, food texture, method of feeding, behaviour (parent and child) and sundry. The category of 'substance' describes anything the child eats or drinks (water/juice, milk, savoury, sweet), 'texture' describes food consistency (solid, semi-solid, purée), and 'method' describes the method of feeding (bottle, feeder-cup, spoon, finger). The category of 'behaviour' consists of two sub-categories: one describes the mother's actions which are directly related to the child's feeding behaviour during the meal and the other describes the child's actions which are directly related to being fed or eating food. A 'sundry' category includes a code for indicating coding mistakes which could be corrected later, enabling coding sessions to continue in cases where a code was entered in error.

Table 3.2 shows the Behavioural Coding Inventory. It is divided into the categories described above and shows the separate codes used for analysis in this study. The single upper-case alphabetical letter is the code used to stand for the behavioural term in brackets which is followed by a brief specification of the behaviours that fall within that code. Instructions which clarify potentially ambiguous situations were added to the revised version of the Inventory by Young (1997) and Kasese-Hara (1997) and these can be seen in Appendix Five: Instructions for Behavioural Coding Inventory.

Table 3.2. Categories comprising the Behavioural Coding Inventory

Substance:		L (*water/juice*) Q (*milk*) X (*savoury*) C (*sweet*)	
Texture:		P (*purée*) D (*semi-solid*) Z (*solid*)	
Method:		U (*bottle*) B (*cup/feeder*) O (*spoon*) F (*finger*)	
Behaviour:			
	Parent	G (*give*)	Brings spoon/food/bottle/cup to infant's mouth to place in mouth
		H (*hand*)	Places food/drink in child's hand (not placing food in front of child)
		W (*withdraw*)	Withdraws spoon/food/bottle/cup before child reacts to offer of food
		T (*takeoff*)	Takes off cup/bottle directly from child's mouth
		M (*model*)	Mother models food intake
	Child	A (*accept*)	Accepts food/drink from spoon/mother's hand/bottle/cup directly into mouth
		R (*refuse*)	Child refuses to open mouth or closes mouth as spoon/cup etc. approaches and before it is fully in mouth and/or turns head away, arches back, pushes spoon away, covers mouth
		J (*reject*)	Child spits out drink/food after *accept* or *feedself*
		F (*feedself*)	Child grasps food/spoon/bottle/cup and brings it towards mouth without assistance (assumes child is successful in getting some food into mouth)
		K (*release*)	Child removes bottle/cup from mouth
		N (*misses*)	Child fails to get any food into mouth in an attempt to self feed
Sundry:		I (*feeding invisible*) V (*feeding visible again*) E (*error*)	

The behaviour was coded from the video recordings for each meal and written out as an output file '*.obs', which consisted of a list of coded behaviour with the time that each behaviour was coded to the nearest decimal minute. The wild card (*) refers to the ID name of an individual file and .obs is common to all coding output files. An example of an output file can be seen in Appendix Six: Example of a behavioural coding output file. The statistical procedures were carried out using SPSS. The *.obs files were converted using a UNIX macro and written out to a *.rl file which converted the time formats of the *.obs files into a form that SPSS could read.

A program was created to carry out the analysis in SPSS sequentially on all *.rl files. The SPSS command file can be seen in Appendix Seven: Example of an SPSS command file. SPSS was then used to run computations and the outputs from this procedure were written out to a separate file (*.out) for each meal. The outputs included the count of individual acts observed in the feeding episode entered under each defined category, and the time of onset of each act in seconds. The times of the individual acts were converted from the hour, minute and second format to seconds from the first act (start of the meal), and the precise duration of the complete meal could be calculated from this. Summary information was saved in a data file for all subjects for subsequent statistical analyses.

In order to conduct further analysis on the meals taking into account whether the child was eating savoury or sweet food, another program was created in SPSS to split the records in the *.rl files into the savoury and sweet sections of the meals. SPSS was used to run the computations on all the *.rl files sequentially and the output from this operation created *.out files which were written out to a separate file for each component of the meal. Summary information was saved in a data file for all subjects for subsequent analysis.

Verbal comments

The mother's verbal comments to her child during the observed meals was also recorded for this study. Working with verbal data involves a series of separate tasks each of which requires a decision to be made before analysis can take place. Specifically, it is necessary to make transcriptions of the data, segment the data into appropriate units, and create an inventory of nominal categories with which to code the data, before the actual coding of the data ready for analysis can begin.

Although verbal data are typically extremely voluminous and many researchers code only a sample of it (Chi, 1997), all the data collected at both meals for each subject were transcribed. A typed record of the mother's speech directed to the child during the observed meals was made from the video recordings. The mother's comments to other people were not transcribed. Comments made by anyone other than the mother including the index child were not transcribed; generally children of one year are not capable of speech. All speech, but not tone of voice, body movements and so on, was transcribed. Sounds made by the mother were recorded if they were sufficiently distinct to be transcribable. For example, mothers often tend to make sounds such as 'mmm' to indicate the food tastes good, and these were transcribed. One of the advantages of having video recordings is that transcripts can be made at a later stage, using the tape as repeatedly as necessary to obtain accurate transcripts which contain as much detail as required. Once each transcription was completed, the video tape was again replayed and using a stop watch, each successive minute as it elapsed was included in the transcript.

The transcripts were than segmented into units. One important consideration at this point was deciding on 'granularity', or defining the point where units should be cut. A fine-grained approach was adopted for this study because on the whole mothers tend to talk to one-year-olds in a series of short simple phrases rather than long complicated sentences. The transcripts were formed by dividing the speech up into the smallest units possible without losing the meaning of the phrase. An example of a transcript can be seen in Appendix Eight: Example of transcript of mother's verbal comments. This example gives the identity number allocated to the subject, followed by the duration of the meal in minutes and seconds. The transcript also indicates where each successive minute elapsed, and the code allocated to each comment at the far right-hand side of the page.

The Verbal Coding Inventory used for this study was based on a coding scheme developed by Birch et al. (1981) to analyse verbal interaction between family members during meals. Birch et al. coded mother and child while they were being observed in a laboratory setting eating lunch from a standard meal. The lunch conversation was coded using the following categories for the child's speech: food (positive, negative and neutral), own eating, requests for assistance and comments not related to food. The mother's speech was coded using the categories of: food (positive, negative and neutral), child's eating (positive, negative and neutral), own eating, offers of assistance, prompting consumption and comments not related to food.

For this study, an appropriate subset of the categories from Birch et al.'s (1981) study was used. Birch et al. had categories for children's speech which were inappropriate for the age range of children taking part in this study, so these were omitted. The codes for the mother were included in their entirety with one slight modification and two additional codes. The category of 'prompting consumption' was modified to include offers of food, reflecting the fact that the mother rather than the researchers were supplying the food in this instance. The categories of 'mother's eating' and 'untranscribable' were included to deal with any comments the mother made about her own food preferences and those which were difficult to transcribe, respectively. Briefly, the category of '*food*' describes any comments about the food served at the target meal, '*child's eating behaviour*' describes comments about the child's eating behaviour, '*verbal offers*' describes any attempts to give the child food or prompt its consumption, '*offers of assistance*' describes any comments made to offer the child help in consuming food, '*child's condition*' describes comments about the child's condition (hunger or satiety), '*mother's eating*' describes the mother's comments about her own eating habits and food preferences, '*non-food*' describes any comments which do not fall into any of the previous categories, and the category of '*untranscribable*' was used for any untranscribable comments. A set of instructions was devised in order to keep the coding consistent. The instructions can be seen in Appendix Nine: Instructions for Verbal Coding Inventory.

The Verbal Coding Inventory can be seen in Table 3.3. It is divided into the categories described above and shows the separate codes used for analysis in this study. The single upper-case alphabetical letter is the code used to stand for the category of verbal behaviour. These letters are followed by their descriptive terms in brackets and a few examples of comments that might fall into each category.

Once the transcripts had been segmented, the units were coded using the Inventory. One problem that arises during coding is the amount of context to consider in interpreting the comment (Chi, 1997). This was tackled by using the video recording to provide the extra information needed to know what the mother was referring to. It was important at this stage to be consistent about the amount of context to consider in coding, and it was decided that minimal context should be used, keeping the interpretation at the level of the segment being coded. The context on the videos were taken into account from less than five seconds before to five seconds after the comment had been uttered.

The procedure of making transcripts and coding them was carried out on all the data, and the counts for all the variables were entered into SPSS for subsequent analysis.

Table 3.3 Categories comprising the Verbal Coding Inventory

Code	**Examples**
A (*food - positive comments*)	Does that taste nice? Do you like that? Mmm.
S (*food - negative comments*)	You don't like that, do you? Is that too hot? Is it too lumpy?
D (*food - neutral comments*)	Is that your bread? Let's see if you like this. Is there too much here?
J (*child's eating - positive comments*)	You've eaten it all up. Good girl/boy. Are you savouring it?
K (*child's eating -negative comments*)	What a mess you're making. Be careful. You're eating too fast.
L (*child's eating -neutral comments*)	You don't want that, do you? I think you've finished now. Are you still chewing?
O (*verbal offers*)	Ready? Try some of this. Child's name.
H (*offers of assistance*)	I'll put it on the spoon. Do you want me to feed you that? Put your spoon that way round.
C (*child's condition*)	You must be hungry. Are you full now? Are you thirsty?
M (*mother's eating*)	Can I have some? I like it. This is my yoghurt.
N (*non-food comments*)	Are you going to get out now? Shall we get your sister a drink. Sit up properly.
Z (*untranscribable*)	Untranscribable comments.

Pilot study

Once ethical approval had been granted and training in the anthropometric measurement of children completed, a pilot study of two mother and child pairs was conducted. A pilot study was essential for three reasons. First, it was necessary to become familiar with the video recorder and measuring equipment, and to practise the written recording procedures. By running through the whole procedure, any potential problems could be identified and dealt with. Second, the pilot video tapes were needed in order to learn and practise the coding procedure as specified by the Behavioural Coding Inventory. Third, the pilot video tapes were needed in order to establish the most effective way of making the verbal transcripts, to create the categories for the Verbal Coding Inventory, and to practise the coding procedure once it had been devised.

As a result of the pilot study, some of the written record sheets were modified to make them easier to complete. Apart from this small detail, the procedure was considered to be very workable and did not require any changes to be made.

Chapter Four

Results: Participants

Recruitment of participants

During the visits to the baby clinics every attempt was made to approach all mothers with babies. There were two main reasons for mothers being unwilling to take part at this stage: either they disliked the idea of being video recorded, or they felt taking part would be too time consuming usually due to work commitments. Eleven mothers dropped out of the study between the first visit and the observations, and there were various reasons for this. Three of the children became ill and were too old to take part by the time they had recovered; two mothers returned to full-time employment and felt they did not have enough time to spare; one mother was expecting another baby and felt too tired; and five mothers changed their minds about participating. A total of 100 mother and child pairs took part in the study.

Parental characteristics

The parental characteristics reported in this section are taken from the Child Feeding Questionnaire completed by the mother. Table 4.1 shows the educational status of the parents. The sample was fairly evenly distributed in terms of education; overall 41% of mothers and fathers left full-time education at 16 years or under, 25% between the ages of 17 and 18 years and 32% remained in full-time education until 19 years of age or over.

Table 4.1 Parental age at leaving full-time education

Age at leaving full-time education	Mothers	Fathers[A]
16 or under	31	51
17 or 18	35	14
19 or over	34	31
n	100	96

Table 4.2 shows the socio-economic status of the parents in the sample based on the father's occupation; 67% of the sample was middle class belonging to social classes I, II and IIINM, and 33% of the sample was working class belonging to social classes IIIM, IV and V.

Table 4.2 Parental socio-economic status

Social Class	Mothers	Fathers[B]
I	5	11
II	25	32
IIINM	45	19
	—	—
IIIM	10	20
IV	14	6
V	0	4
	—	—
Unclassified[C]	1	0
n	100	92

[A] Four mothers declined to give information about the child's father's educational history
[B] Eight mothers declined to give information about the child's father's occupation
[C] Defined as having no employment history

To assess the representativeness of the sample, comparisons were made with a subsample (households with at least one child under five years) of the 1992 General Household Survey (Thomas et al., 1994). In the subsample, the head of household was classified based on occupation, and was always the male if he was a resident of the household. The six social classes were collapsed into two groups: non-manual and manual. Exactly the same criteria were used to classify the head of household for the present sample and the comparison can be seen in Table 4.3.

Table 4.3 Comparison of socio-economic status of the sample with National 1992 GHS sample

Social Class	**Present sample**	**National 1992 GHS sample**
Non-manual	64	44
Manual	36	51
Unclassified	0	5
n	100	100

Table 4.3 shows that the sample had a higher proportion of middle-class families than the National 1992 GHS sample. The proportion in the sample (0.64) was tested for a significant difference from the true proportion in the comparison population of 0.44 using the Z test statistic (Moore, 1995). The difference was found to be significant (Z=3.86, n=92, p<0.01, two-tailed).

Table 4.4 summarises the age of the mothers in the sample on observation day. Eleven mothers were 24 years or under, 67 mothers were 25-34 years and 22 mothers were 35 years or over.

Table 4.4 Age of mothers on observation day

Age of mother on observation day	***n***
19 years or less	2
20-24 years	9
25-29 years	29
30-34 years	38
35-39 years	19
40 years or over	3
n	100

For 57 mothers the index child was their first, 28 mothers had two children and 15 mothers had three or more.

By the time children are 12 months old, many mothers have returned to work. One of the requirements of this study was that the mother was feeding the child during observation, and for this reason mothers in full-time work were often observed at week-ends. Two meals (lunch and evening meal) were recorded within one day for all participants with the exception of one, for whom this was not possible. Video recording took place when the children were generally well, although in a few cases the child had minor illnesses such as slight colds. All the children were 52-61 weeks old when video recording of mealtimes took place.

Parental anthropology

Data on maternal weights and heights were measured on the observation day. Data on the fathers' weight and height were collected from maternal reports. If both weight and height are obtained they can be used together to provide a simple measure of fatness (Cole et al., 1995). A very flexible index of overweight is provided by the body mass index (BMI) calculated as weight (kg) divided by height (m) squared, and it has been used widely in adults (Garrow and Webster, 1985). The body mass index (BMI) was calculated for mothers and fathers. Table 4.5 shows the descriptive statistics for parents' anthropometric characteristics.

Table 4.5 Percentiles and other descriptive statistics for parents' anthropometric characteristics

	Minimum	**25th**	**Median**	**75th**	**Maximum**	**Mean**	**SD**
Weight (kg)							
Mothers (*n*=99)[A]	42.70	56.85	63.60	70.55	105.20	64.47	11.65
Fathers (*n*=95)	61.20	70.40	82.60	88.50	120.70	80.88	11.24
Height (m)							
Mothers (*n*=99)	1.51	1.59	1.62	1.68	1.83	1.63	.07
Fathers (*n*=95)	1.55	1.74	1.80	1.83	1.93	1.79	.07
BMI (kg/m^2)							
Mothers (*n*=99)	17.43	21.33	23.28	26.12	39.89	24.23	4.28
Fathers (*n*=95)	17.88	23.17	24.92	26.94	38.09	25.23	3.10

[A] One mother declined to be measured for height and weight and five mothers were unsure of the father's height and weight

Table 4.6 shows a summary of the numbers of mothers and fathers within each BMI category according to internationally accepted categories for classification of BMI (Breeze et al., 1994).

Table 4.6 BMI classification of mothers and fathers

BMI (kg/m²)		**Mothers** *n*	**Mothers** %	**Fathers** *n*	**Fathers** %
< 20	(underweight)	12	12.1	3	3.2
20-25	(desirable)	55	55.6	45	47.4
25-30	(overweight)	24	24.2	42	44.2
> 30	(obese)	8	8.1	5	5.3
n		99		95	

Mothers' self-reported eating characteristics

The mothers taking part in the study all completed the Three-Factor Eating Questionnaire (TFEQ) to assess their degree of *restraint*, *disinhibition* and *hunger* and the distributions of their scores on these subscales can be seen in Figures 4.1, 4.2 and 4.3 respectively. The figures show that there were participants with scores at both extremes of the subscales *restraint*, *disinhibition* and *hunger*.

Following the histograms, Table 4.7 shows the descriptive statistics for the subscales on the TFEQ. The TFEQ has 21 items for restraint, 16 for disinhibition and 14 for hunger and the table shows that each subscale had participants who scored the lowest possible scores. The maximum scores were not represented on any of the subscales but nevertheless, the distribution of scores for *restraint*, *disinhibition* and *hunger* is wide, as would be expected from the results of the preliminary study.

Figure 4.1 Histogram showing the distribution of scores for *restraint*

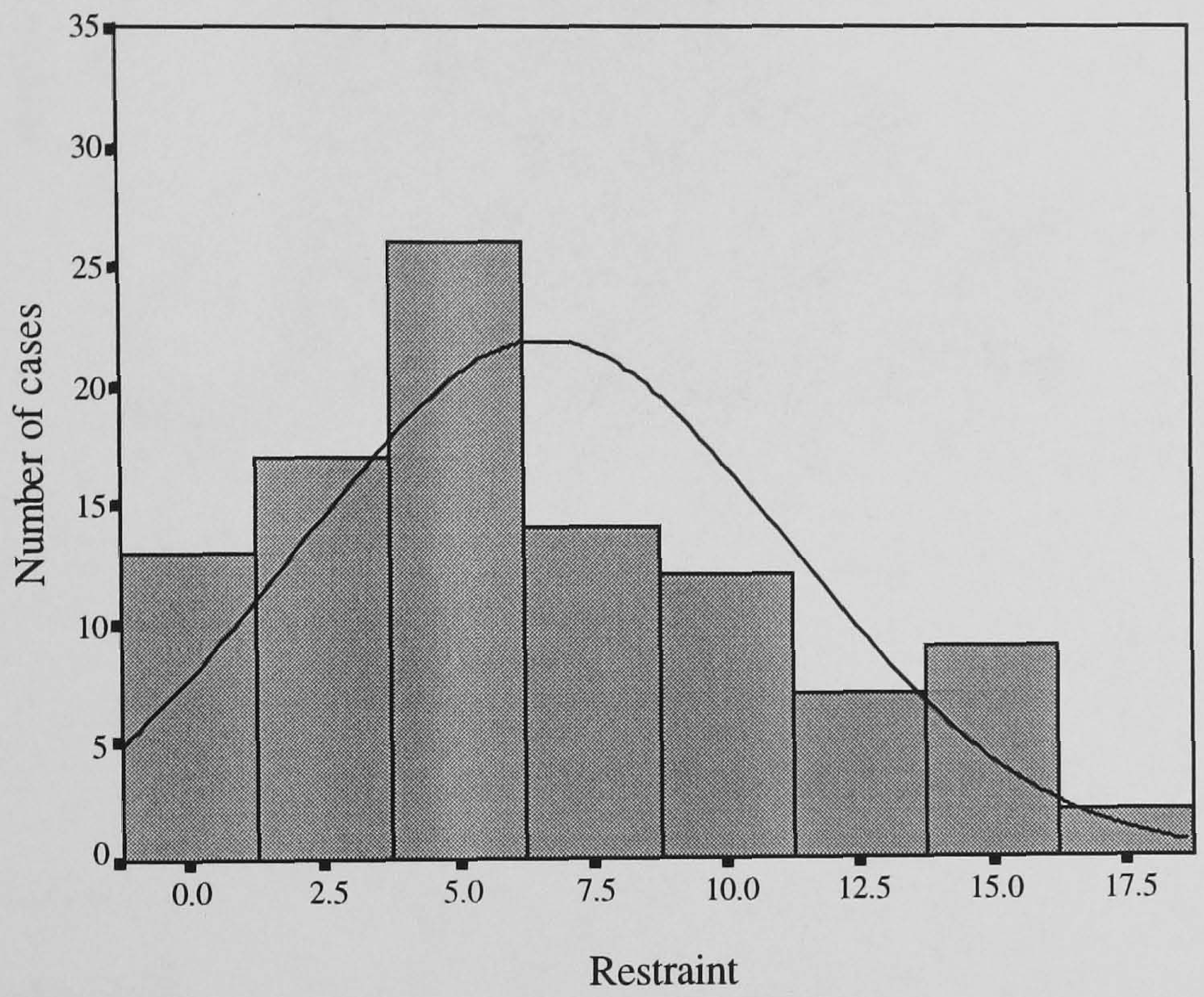


Figure 4.2 Histogram showing the distribution of scores for *disinhibition*

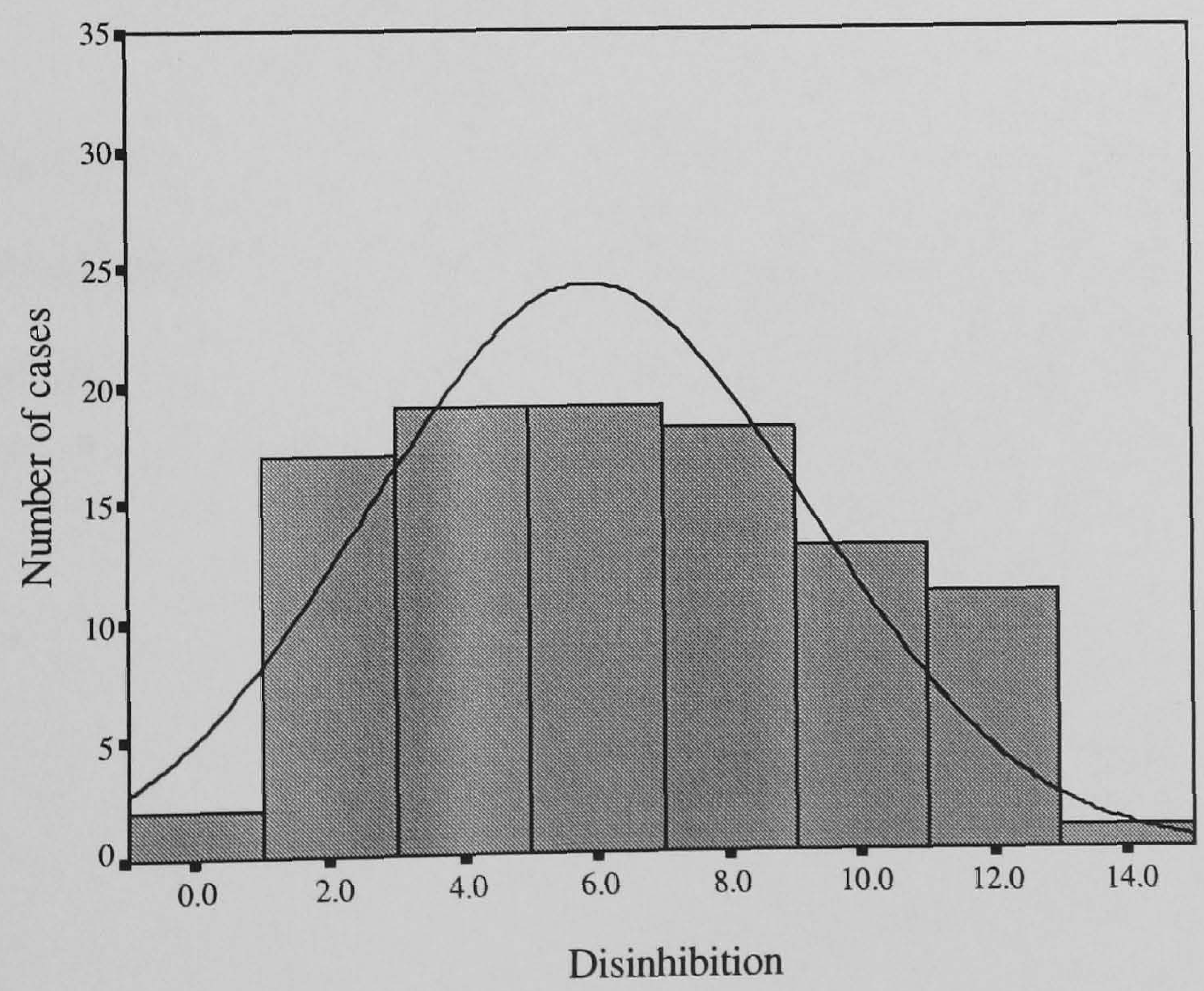


Figure 4.3 Histogram showing the distribution of scores for *hunger*

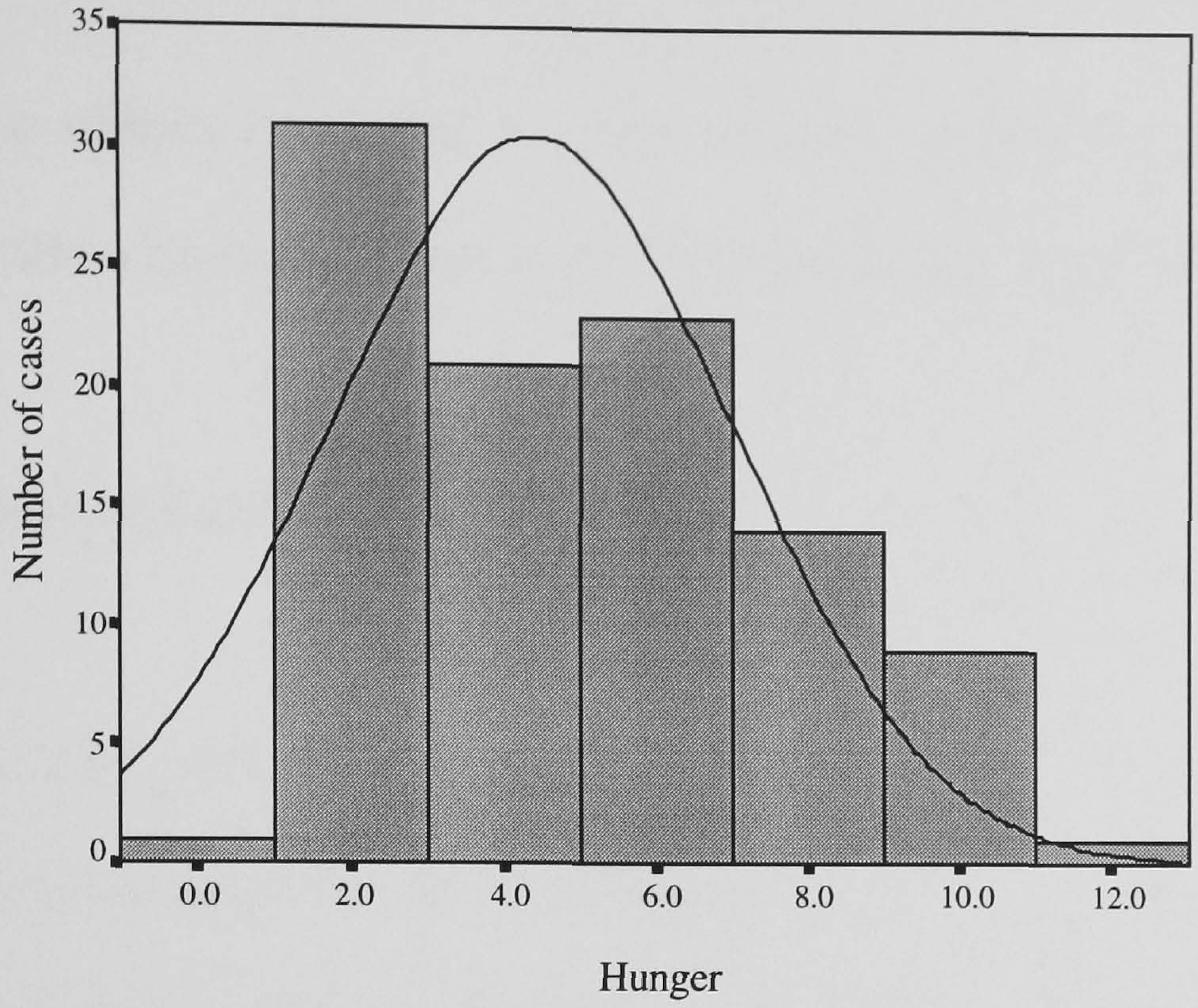


Table 4.7 Percentiles and other descriptive statistics for *restraint*, *disinhibition* and *hunger* (n=100)

	Minimum	25th	Median	75th	Maximum	Mean	SD
Restraint	0.00	3.00	6.00	10.00	18.00	6.7	4.6
Disinhibition	0.00	3.00	6.00	8.50	13.00	5.9	3.3
Hunger	0.00	2.00	4.00	6.00	11.00	4.4	2.6

Child characteristics

The sample comprised 51 male children and 49 females. The mean age of the children on observation day was 385 days (range 363-428 days).

Child anthropology

All infant weights included in the analysis other than the 12-14 month weight taken on the observation day and the weight taken at the 18 month visit, were obtained from parent-held child health record books. Table 4.8 shows the descriptive statistics for the anthropometric characteristics of the sample of children at birth, 12 and 18 months.

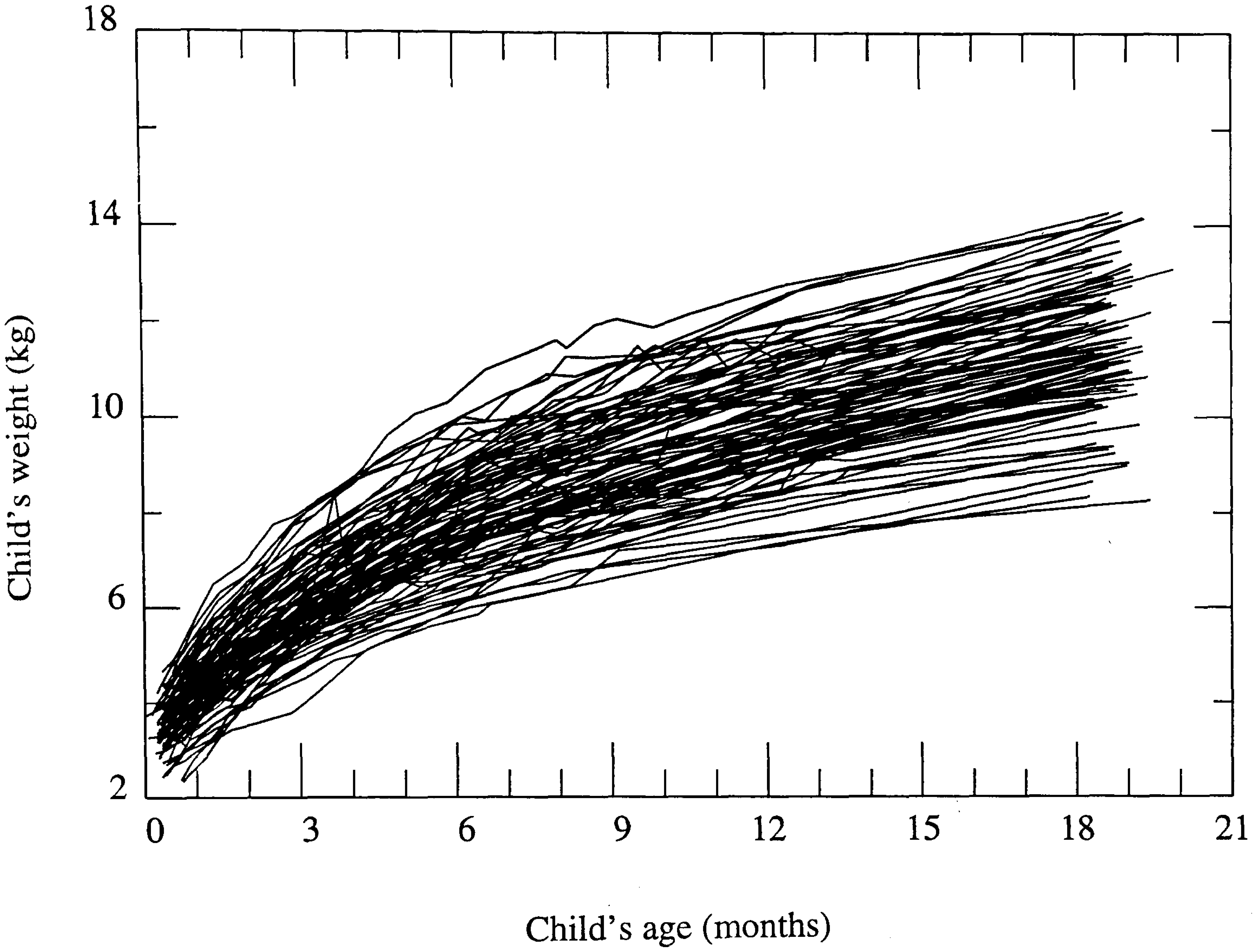
The child's weight records held by the mother were recorded and Figure 4.4 shows the weight curves from birth for the whole sample of children reconstructed from these parent-held records. Figure 4.4 shows there is a relatively high change in body weight from birth to 12 months followed by a relatively low change in weight from 12 to 18 months.

Table 4.8 Percentiles and descriptive statistics for child anthropometric characteristics (n=100)

	Minimum	25th	Median	75th	Maximum	Mean	SD
Birthweight							
Males	2.10	3.24	3.52	3.84	4.62	3.52	.47
Females	1.96	2.99	3.29	3.53	4.15	3.28	.47
All	1.96	3.14	3.46	3.74	4.62	3.41	.48
Weight 12 months (kg)[A]							
Males	7.60	9.90	10.50	11.34	12.75	10.58	1.08
Females	7.32	9.16	9.64	10.40	12.62	9.75	1.16
All	7.32	9.37	10.07	11.13	12.75	10.18	1.19
Weight 18 months (kg)							
Males	9.00	11.20	11.91	12.52	14.30	11.96	1.23
Females	8.26	10.40	11.12	12.24	14.12	11.19	1.38
All	8.26	10.70	11.48	12.40	14.30	11.55	1.36
Length 12 months (cm)							
Males	73.7	76.5	78.2	79.8	83.0	78.1	.03
Females	70.4	74.0	75.5	77.6	83.3	75.9	.03
All	70.4	75.1	77.0	78.8	83.3	77.0	.03
Length 18 months (cm)							
Males	79.4	82.4	83.5	86.2	90.2	83.9	.03
Females	76.0	80.3	82.0	83.5	89.5	82.0	.03
All	76.0	80.6	83.0	84.2	90.2	82.9	.03

[A] Two male children were lost at follow-up, due to a family move

Figure 4.4 Weight curves from birth to 18 months for whole sample



Figures 4.5 and 4.6 show the relationship between weight and length in the sample at the age of 12 months and 18 months respectively. As would be expected the correlations between each were statistically significant ($r_{(98)}$=0.74, p<0.0005 at 12 months and $r_{(98)}$=0.72, p<0.0005 at 18 months).

Figure 4.5 Scatterplot showing the relationship between child's weight and length at 12 months

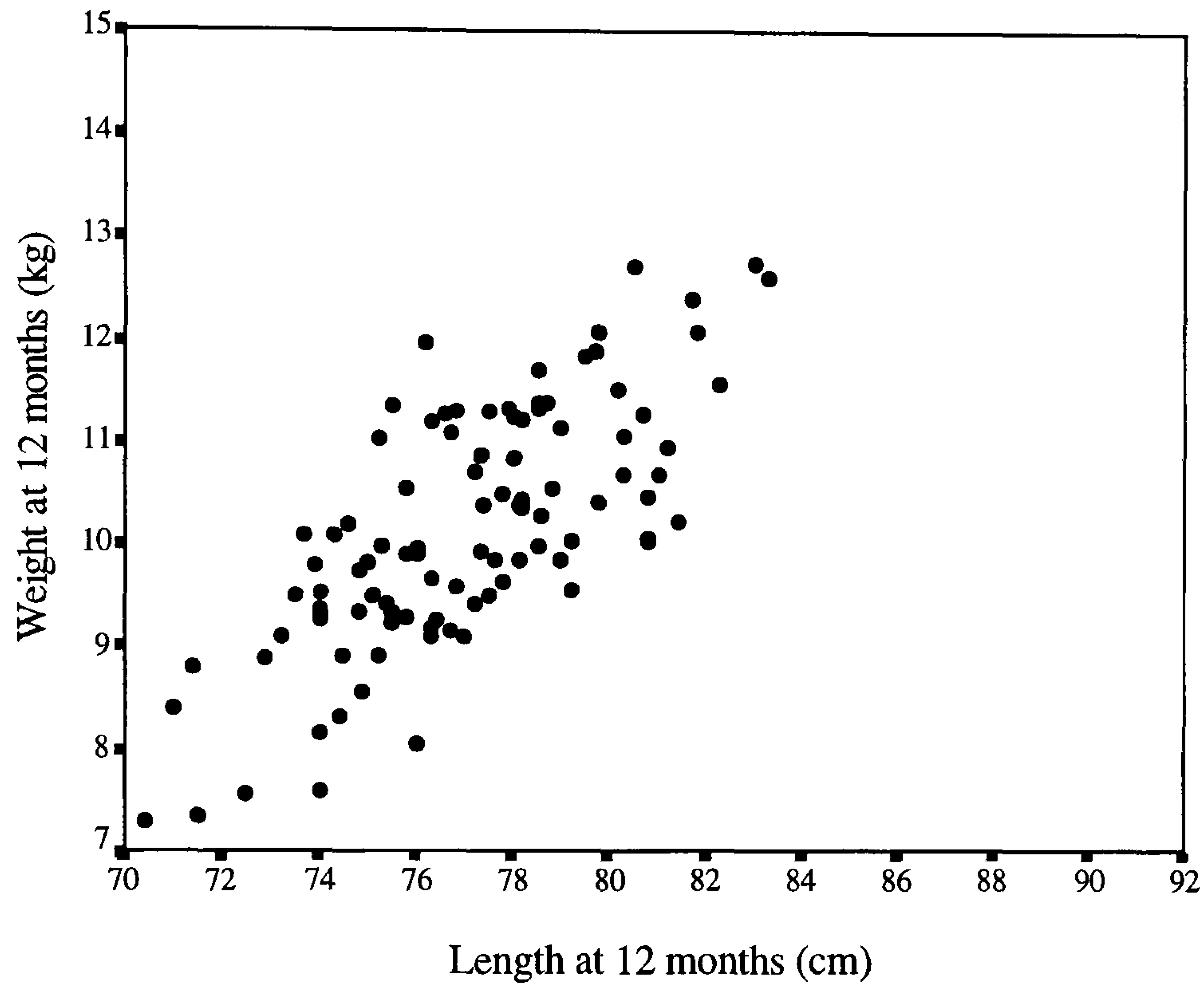
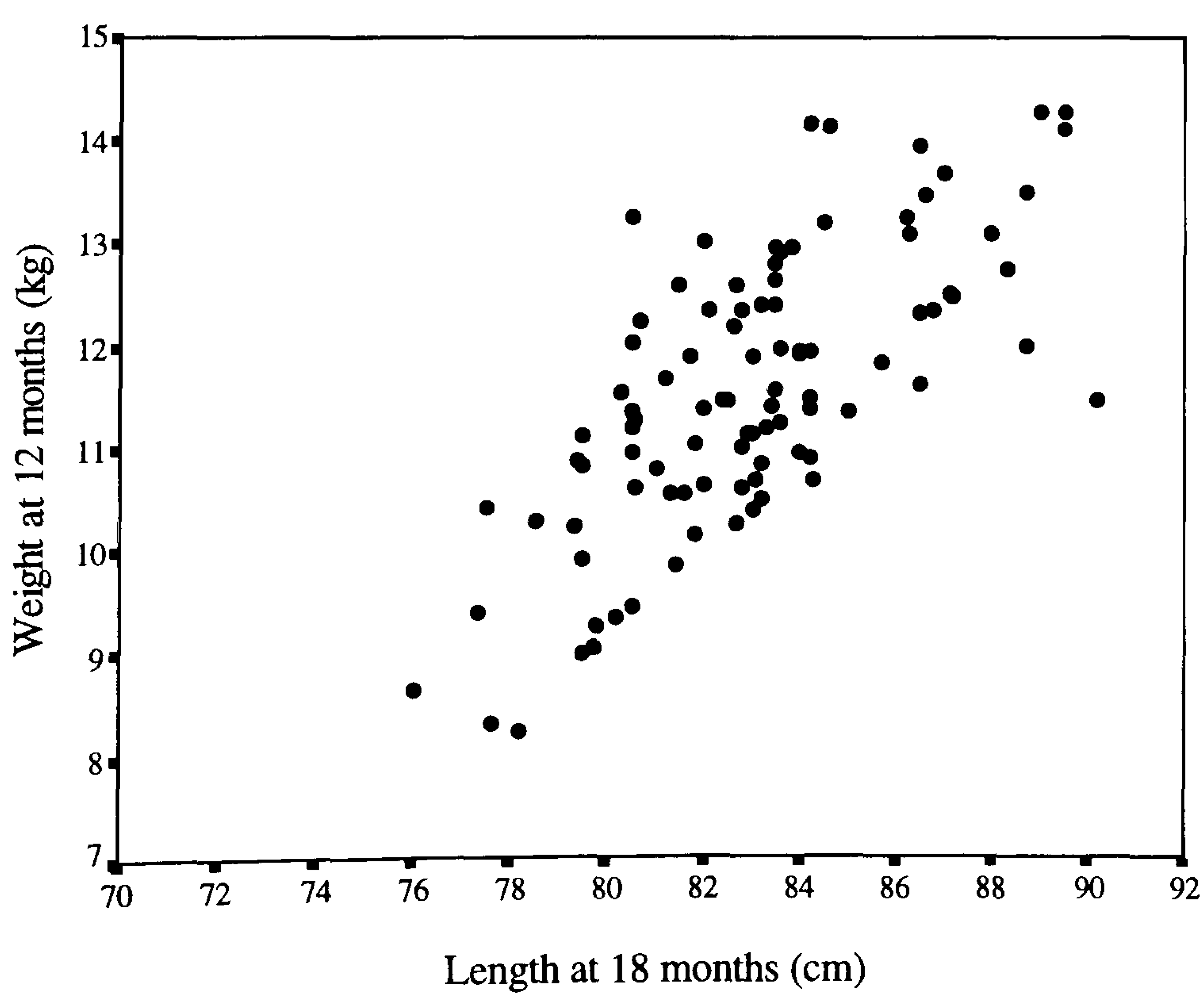


Figure 4.6 Scatterplot showing the relationship between child's weight and length at 18 months



Summary

In dividing the sample into fathers in non-manual and manual employment, it was shown that 67% of the sample was middle class and 33% working class. This distribution was found to be significantly different from a comparison subsample of households with at least one child under five years (Thomas et al., 1994); the sample was biased towards middle-class families. There was a small amount of missing data about the father's occupation due to some mothers declining to give information about the child's father. However, the comparison of socio-economic status between the samples should not be affected for the present study because each of these cases were ones where the father was not living in the child's home. In these cases, the mother's occupation was used in the way it was for the comparison subsample from the 1992 General Household Survey (Thomas et al., 1994). Although a more representative sample would have been ideal, in an intensive observational study using volunteers, the individuals who take part cannot be specified in advance. It is important for future replicative studies to report the socio-economic status of their samples, so that the generalisability of results can be assessed by comparing such characteristics.

It was important for the study that there was a wide range of scores on the subscales of the Three-Factor Eating Questionnaire, and this was found to be the case; each scale had participants scoring at the lowest end of the scale although none of the scales had participants scoring the highest possible scores. This is in contrast to the distributions for the preliminary study, in which each subscale had participants who scored the lowest and highest possible scores, with the exception that no participant scored zero on the disinhibition scale.

Only one mother declined to be measured for height and weight. Five mothers could not report the height and weight of the child's father. Although all the other mothers did, it was noticed that many appeared to be guessing, especially in the case of the father's weight. For this reason the data are reported but have not been used in any way. The mothers' BMI scores were normally distributed, and some mothers fell into each category of underweight, desirable, overweight and obese in the classification of BMI according to Breeze et al. (1994).

The sample of children was very evenly divided into boys (*n*=51) and girls (*n*=49). Two mother and child pairs were lost at the 18 month follow up; both children were boys. As would be expected mean birthweight, mean weight and mean length at 12 months and 18 months were all slightly higher for boys than girl. The scores for each were normally distributed. The data for the weight curves from birth show there is a relatively low change in weight from 12 to 18 months.

Chapter Five

Results: Reliability of measures

Assessing reliability of measures

One of the most important considerations in obtaining behavioural data is the quality of coding. It is important that the coding procedure and criteria are specified precisely in advance, so that different observers categorise items in the same way. Assessing the reliability of coding schemes is important for all studies and it can be checked by either testing stability (the same coder codes the data twice to show intraobserver inconsistencies) or by testing reproducibility (different coders code the same data using the same criteria to show interobserver differences) (Bowers and Courtright, 1984). The type or types of reliability which are evaluated depends on the specific problems associated with the study being conducted.

Reliability of measures used in the behavioural analysis

The interobserver reliability of the Behavioural Coding Inventory was established for a previous study on feeding behaviour study within the Psychology Department of the University of Durham (Kasese-Hara, 1997). This reliability study was carried out by two researchers who were experienced in research on children's feeding behaviour. The results of the reliability study were obtained from one coded meal from each of the 30 children in the sample, all of which were of a similar age to those participating in this study. The results showed high positive correlations (i.e. Spearman's $\rho>0.70$) between observers for most variables, and moderate positive correlations (i.e. $0.60<\rho<0.70$) for the remainder.

For the purposes of this study, an additional analysis of intraobserver reliability was carried out on a subsample of the behavioural data. This was for three reasons. First, the interobserver reliability of the Inventory has already been established as being high or moderately high for all variables. Second, the data for this study took almost eighteen months to collect because of the large number of participants observed, and behavioural coding for each participant was completed within a short time after the observation day. Consequently, the observer's procedure may have changed over time, and it was important to establish whether or not this was the case before any data analysis took place. Third, the author of this study can 'touch type' rapidly and accurately which enables coding to continue throughout the video recordings without looking at the keyboard. This is a huge advantage when coding complex behaviour (when many things can be happening rapidly) but would inevitably make interobserver comparisons relatively weak due to coders' different levels of familiarity with the keyboard.

For the intraobserver reliability analysis ten meals were selected at random from the complete data set and recoded by the same researcher before any other analysis began. The distributions for all the variables was then inspected. The values for the variables cannot be less than zero, and as is common with such scales, the distributions for all the variables were positively skewed (i.e. scores were clustered at the lower end of the scale). This means that the assumptions of a parametric test were not met, so Spearman's ρ ranked order coefficients were calculated. This statistic resolves the problem of the possibility of a few extreme points having undue influence on the results as Spearman's ρ describes the linear relationship between the ranks of the scores, rather than the raw score.

Table 5.1 shows descriptive statistics and correlation coefficients (Spearman's ρ) for the intraobserver reliability study. The correlations between the two codings for *takeoff* and *release* were perfect (i.e. $\rho=1.00$). This probably reflects the fact that both variables refer to the end of a drink; either the mother or the child is removing the bottle or beaker from the child's mouth. In this way, these variables can be seen as a count of the number of sips of drinks the child had over the course of the meal, which was easy to code consistently. The correlations for *give*, *hand* and *feedself*, were not perfect, but they were all very high ($\rho>0.90$). These three variables refer to actions of the child feeding itself or the mother feeding the child and were generally straightforward to code. The correlations for *accept*, *refuse*, *reject* and *model* were all high ($0.70<\rho<0.90$) but only moderately high. These variables refer to the child's response to the mother feeding it, the child's response to food once it is in its mouth and the mother modelling food intake: the correlations indicate that these actions are slightly less straightforward to code consistently. The code *withdraw* had only a moderate correlation of 0.58. The action of the mother withdrawing food was rare, and the data from this category were not used in any further analyses. The codings for the category *misses* were not reliable. This action, however, occurred very rarely, as children of this age group are generally able to get food into their mouth if they are motivated to do so. The variable *misses* was not included in any further analyses.

Table 5.1 Intraobserver reliability study: percentiles, other descriptive statistics and correlation coefficients (Spearman's ρ) for the first and second coding of the variables from the Behavioural Coding Inventory

	Minimum	25th	Median	75th	Maximum	Mean	SD	Spearman's ρ
Give								
First	0.00	6.00	27.40	55.00	65.00	27.40	25.36	0.98
Second	0.00	5.00	23.00	53.00	66.00	28.30	26.36	$p<.0005$
Hand								
First	0.00	0.00	0.50	2.00	6.00	1.40	1.96	0.91
Second	0.00	0.00	1.00	3.00	7.00	1.80	2.35	$p<.0005$
Feedself								
First	5.00	31.00	40.00	56.00	106.00	46.70	32.97	0.97
Second	5.00	30.00	40.00	59.00	102.00	47.10	33.56	$p<.0005$
Accept								
First	0.00	3.00	11.00	33.00	56.00	17.40	19.05	0.82
Second	0.00	3.00	11.50	32.00	58.00	17.60	19.33	$p<0.002$
Refuse								
First	0.00	2.00	3.00	20.00	26.00	9.80	10.60	0.77
Second	0.00	2.00	6.00	21.00	26.00	10.60	9.99	$p<0.005$
Reject								
First	0.00	0.00	1.00	2.00	8.00	1.80	2.53	0.89
Second	0.00	0.00	1.00	2.00	9.00	1.90	2.77	$p<.0005$
Withdraw								
First	0.00	0.00	0.00	0.00	2.00	0.30	0.67	0.58
Second	0.00	0.00	0.00	0.00	1.00	0.10	0.32	$p=0.004$
Takeoff								
First	0.00	0.00	0.00	3.00	4.00	1.00	1.63	1.00
Second	0.00	0.00	0.00	3.00	4.00	1.00	1.63	$p<0.0005$
Release								
First	0.00	0.00	1.50	3.00	8.00	2.10	2.56	1.00
Second	0.00	0.00	1.50	3.00	8.00	2.10	2.56	$p<0.0005$
Model								
First	0.00	0.00	0.00	1.00	8.00	1.50	2.95	0.89
Second	0.00	0.00	0.00	1.00	7.00	1.50	2.68	$p<0.001$
Misses								
First	0.00	0.00	0.00	0.00	1.00	0.10	0.32	-0.11
Second	0.00	0.00	0.00	0.00	1.00	0.10	0.32	$p=0.760$

Reliability of measures used in the verbal analysis

The Verbal Coding Inventory used for this study was derived from Birch et al.'s (1981) study. They reported interobserver reliability coefficients at 0.85 or greater, but included no specific instructions on its use in their publication. For this reason, and because the coding scheme was refined for this study, it was important to establish that the definition for each category was specific enough to allow for accurate coding. In order to do so, an interobserver reliability study was conducted on a subset of the data using two independent observers to determine whether different coders would code the data in the same way.

According to Ericsson and Simon (1993) even when interobserver agreement is high there can be difficulties in interpreting the results. They discuss two potential problems. The first is bias towards the confirmation of hypotheses put forward, which occurs when coders have prior knowledge of the hypotheses being tested. To avoid this, the second coder carrying out the reliability study for this project was not informed of the hypotheses being tested. Although experienced at coding verbal data, she was unfamiliar with this particular field of research. The second problem is the influence of previously coded data on subsequent coding decisions; it is possible that coders remember previous coding, and other information about earlier segments which influences subsequent coding. One way to eliminate this problem is to code the segments in a random order. However, for this study context was provided by using the video recordings making it impractical to use this solution. Instead stringent criteria for using context from the video tape were used; context was defined as five seconds before and after each utterance was made. It was hoped that this would increase objectivity. Because random order could not be used for this study, evaluating reliability was an especially important issue before analysis of data could take place.

A research psychologist from the Psychology Department of the University of Durham who has a great deal of experience at coding verbal data was enlisted to conduct the reliability study. She was trained to use the Verbal Coding Inventory during two training sessions. During the first, the categories, the definitions and instructions for use were discussed. At the end of this session, she was given one transcript and the appropriate video recording for practice. She was given only the categories and their descriptions, but no examples of items which might fall into each category were included. This was because the reliability study was conducted primarily to test whether the categories were defined specifically enough for two coders to code in the same way, and the results are more informative if the test is made as stringent as possible. When she had coded this transcript, the second training session took place. Discrepancies in the way the data had been coded by the two coders were discussed until agreement on all items had been reached. As a result of this meeting, some minor changes to the definitions of the categories and instructions were made in order to make the criteria more clear and specific.

For the interobserver reliability analysis eight meals were selected at random from the complete data set and coded by the second coder. The distributions for all the variables were then inspected. The values for these variables cannot be less than zero, and as is common with such scales the distributions for all the variables were positively skewed (i.e. scores were clustered at the lower end of the scale). The assumptions of a parametric test were not met, so Spearman's ρ coefficients were calculated. Table 5.2 shows the descriptive statistics and correlation coefficients for the interobserver reliability study.

Table 5.2 shows that the correlations between *food* (*positive* and *neutral*), *child eating behaviour (negative)*, *verbal offers*, *child's condition*, *non-food comments* and *untranscribable* were all perfect or near perfect correlations (i.e. $\rho>0.95$). The correlations for *child eating behaviour* (*positive* and *neutral*) were also very high (i.e. $\rho>0.80$). Taken together, this shows that the coding for two categories concerning food and all the categories concerning child eating behaviour were possible to be coded consistently and therefore reliable. In addition the mother's verbal offers of food, her comments about the child's satiety and hunger and all those unconcerned with food or the meal, were reliable. Untranscribable items were denoted on the transcripts by empty brackets, i.e. (   ), so as would be expected, there was a perfect correlation for the category *untranscribable*. The correlation for *mother's eating* was moderate (0.66) but not significant. The correlations for the remaining categories *food* (*negative*) and *offers of assistance* were low and not significant. The categories for which the correlations were not significant (*mother's eating*, *food* (*negative*) and *offers of assistance*) were not included in any further analyses.

Table 5.2 Interobserver reliability study: percentiles, other descriptive statistics and correlation coefficients (Spearman's ρ) for the two coders using the Verbal Coding Inventory

	Minimum	25th	Median	75th	Maximum	Mean	SD	Spearman's ρ
Food								
Positive								
Coder 1	5.00	9.00	12.50	24.00	63.00	19.88	19.30	0.99
Coder 2	5.00	8.00	13.50	23.00	62.00	19.50	18.85	p<0.0005
Negative								
Coder 1	0.00	0.00	1.50	3.50	5.00	1.88	1.96	0.46
Coder 2	0.00	0.00	0.50	2.00	4.00	1.13	1.46	p=0.254
Neutral								
Coder 1	0.00	2.50	4.00	8.50	10.00	5.00	3.63	0.98
Coder 2	0.00	3.00	6.00	11.50	16.00	7.13	5.59	p=0.0005
Child eating behaviour								
Positive								
Coder 1	3.00	5.50	11.00	22.00	24.00	13.00	8.57	0.87
Coder 2	1.00	4.50	11.50	14.50	24.00	10.75	7.44	p<0.0005
Negative								
Coder 1	0.00	2.00	9.50	14.50	24.00	9.50	8.25	0.97
Coder 2	0.00	5.00	11.00	23.50	26.00	13.13	9.99	p<0.0005
Neutral								
Coder 1	4.00	8.50	15.50	24.00	29.00	16.13	9.05	0.81
Coder 2	0.00	4.50	5.50	12.00	18.00	7.75	5.78	p=0.001
Verbal offers								
Coder 1	12.00	17.50	34.00	60.00	110.00	43.13	35.37	0.98
Coder 2	9.00	15.50	28.00	4.00	84.00	34.50	26.96	p<0.0005
Offers of assistance								
Coder 1	0.00	0.00	0.00	1.00	3.00	0.63	1.06	0.38
Coder 2	0.00	0.00	0.00	0.00	1.00	0.13	0.35	p<0.352
Child's condition								
Coder 1	0.00	0.00	0.00	0.00	5.00	0.63	1.77	1.00
Coder 2	0.00	0.00	0.00	0.00	5.00	0.63	1.77	p=0.0005
Mother's eating								
Coder 1	0.00	0.00	0.00	2.00	4.00	1.00	1.60	0.66
Coder 2	0.00	0.00	0.00	0.00	1.00	0.13	0.35	p<0.074
Non-food comments								
Coder 1	7.00	15.00	32.00	65.00	79.00	38.75	27.72	1.00
Coder 2	13.00	14.50	52.50	85.50	118.00	54.38	39.86	p<0.0005
Untranscribable								
Coder 1	0.00	0.00	0.00	0.50	1.00	0.25	0.46	1.00
Coder 2	0.00	0.00	0.00	0.50	1.00	0.25	0.46	p=0.0005

Chapter Six

Results: Description of variables

Procedures for variables describing meals

This chapter contains information about the distributions of the principle variables used in the data analysis to describe meals, and the relationship between them across the two meals. They include the duration of the meal, the weight of food served, and the weight of food eaten. The other variables originate from the Behavioural Coding Inventory and Verbal Coding Inventory. Information about the distributions of subscale scores from the Three-Factor Eating Questionnaire (TFEQ) and the anthropometric variables of the mothers and children were described in Chapter Four.

Much of the data collected for the thesis is nominal. Lindsey (1995) makes a distinction between characteristics within individuals and those between individuals. Lindsey recommends that frequencies within individuals (e.g. how often a child feeds itself) should be referred to as 'counts', and frequencies across individuals (e.g. how many children are self feeding) should be referred to as 'frequencies'. The use of this terminology has been adopted throughout the thesis.

The data for the variables described in this chapter could not take a value less than zero but had no upper limit, and the distributions of such variables are often positively skewed (i.e. the majority of scores are at the lower end of the scale). In cases where distributions are not normally distributed, the requirements of parametric tests are not met. For this reason the association between meals for the variables are reported as Spearman's ρ correlation coefficients. Spearman's ρ resolves the problem of a few extreme points having an undue influence because it describes the linear relationship between the ranks of the scores, rather than the scores themselves.

Description of non-behavioural mealtime variables

Four non-behavioural variables central to describing mealtime behaviour were included in the data analysis. The first was meal duration (*duration*). Coding began as soon as food was presented to the child and continued until either the mother removed any remaining food at the end of the meal, removed the child from the highchair or otherwise indicated that the child had finished eating. Video recording continued even in the event of the meal being interrupted, for example by the telephone ringing. The beginning of the meal was defined as the first coded behavioural feeding act and the end was defined as the last coded behavioural feeding act. The program had an in-built timer so the data for this variable were extracted from the behavioural output files by deducting the time of the first coded behavioural act from the time of the last coded behavioural act. This was carried out at a later stage when all the data had been collected.

The other three non-behavioural variables were the weight of the food served in grams (*served*), the weight of the child's food intake in grams (*intake*) and the weight of food uneaten at the end of the meal in grams (*leftover*). These three variables were calculated by weighing the serving plate when empty, then again with the food to be served on it, and once again with the uneaten food. Measuring food intake in children of this age is complicated by the fact that food is often split, dropped, spat out and so on. In cases where this occurred, as much of the food as possible was collected from the highchair and floor after the meal so that it could be weighed with any other uneaten food. The variables discussed here, their descriptions and the way in which they were calculated are shown in Table 6.1.

Table 6.1 Description and formulae for *duration* (mins), *served* (g), *intake* (g) and *leftover* (g)

Other variables	Variable description	Variable calculated as
Duration	Duration of feed in minutes	(time of last feeding act) – (time of first feeding act)
Served	Food served (g)	(weight of plate + served food) – (weight of plate)
Intake	Food intake (g)	(weight of plate + served food) – (weight of plate + uneaten food)
Leftover	Food leftover (g)	(weight of plate + uneaten food) – (weight of plate)

The first stage of data analysis involved inspecting the distributions of the variables *duration*, *served*, *intake* and *leftover*. As expected, the distributions for each were positively skewed. Descriptive statistics for the variables *duration*, *served*, *intake* and *leftover* for both meals are shown in Table 6.2, which also shows the correlation coefficient (Spearman's ρ) for each variable across the two meals.

Table 6.2 Percentiles, other descriptive statistics and correlation coefficients (Spearman's ρ) for the variables *duration* (mins), *served* (g), *intake* (g) and *leftover* (g)

	Minimum	25th	Median	75th	Maximum	Mean	SD	Spearman's ρ
Duration (mins)								
Meal 1	2.95	12.48	17.37	22.15	40.37	18.19	7.43	0.47
Meal 2	5.53	12.16	16.83	26.37	44.87	19.53	8.63	$p<0.0005$
Served (g)								
Meal 1	80.40	208.30	252.80	307.40	580.00	263.74	88.59	0.17
Meal 2	87.90	178.50	234.60	285.80	285.80	239.14	81.48	NS
Intake (g)								
Meal 1	9.10	120.90	169.45	222.25	348.10	173.53	74.02	0.40
Meal 2	17.20	107.00	149.15	198.45	365.10	156.09	71.01	$p<0.0005$
Leftover (g)								
Meal 1	3.30	40.70	74.25	121.30	335.60	90.31	71.33	0.11
Meal 2	2.00	33.00	73.05	118.80	451.10	84.24	69.05	NS

Table 6.2 shows that the correlation for the variable *duration* was statistically significant. Although the correlation is only moderate, this does show that there is some within-subject consistency over the two meals. To my knowledge, there is no published data on the time it takes to feed one-year-old children which have been measured objectively from observed mealtimes. The results from the present study are based on observational data using stringent pre-specified criteria for the beginning (the time of the first coded behavioural feeding act) and end (the time of the last coded behavioural feeding act) of the meal. The median *duration* is 17.4 minutes (semi-interquartile range 12.5 to 22.2 minutes) for meal 1 and 16.8 minutes (semi-interquartile range 12.2 to 26.4 minutes) for meal 2. The median *duration* for all the meals is 18.9 minutes (semi-interquartile range 13.3 to 22.8 minutes).

The correlation for *served* across the two meals was not significant. The correlation for *intake* was statistically significant. This suggests some within-subject consistency over meals, although the association was only a moderate one. Finally, the correlation for *leftover* was non-significant, suggesting that children who left little food at one meal left much more at the next, or vice versa.

Description of variables from the Behavioural Coding Inventory

The behavioural categories in the Behavioural Coding Inventory describe feeding acts such as *give*, *feedself* and *refuse*. For each participant a count of observations coded under each category over the duration of the meal was made: these counts (for *give*, *feedself*, *refuse* etc.) are referred to as 'original variables'. There are two for each child, one from each meal.

The variables *withdraw* and *misses* are not considered because they were shown to be unreliable. The distribution of scores for the original behavioural variables *give*, *hand*, *feedself*, *accept*, *refuse*, *reject*, *takeoff*, *release*, *model* to be used in the analyses were inspected and found to be positively skewed. Table 6.3 shows the descriptive statistics for the original variables for both meals and correlation coefficients (Spearman's ρ) for each variable across the two meals.

Table 6.3 Percentiles, other descriptive statistics and correlation coefficients (Spearman's ρ) for original variables from the Behavioural Coding Inventory

	Minimum	25th	Median	75th	Maximum	Mean	SD	Spearman's ρ
Give								
Meal 1	0.00	33.00	45.50	57.00	124.00	45.50	22.88	0.21
Meal 2	2.00	25.50	39.00	53.50	114.00	41.13	24.13	p=0.041
Hand								
Meal 1	0.00	0.00	0.00	1.00	11.00	0.80	1.85	0.25
Meal 2	0.00	0.00	0.00	2.00	23.00	1.88	23.00	p=0.011
Feedself								
Meal 1	0.00	5.00	20.00	37.50	174.00	25.60	27.68	0.43
Meal 2	0.00	8.00	28.50	48.50	131.00	33.57	29.41	p<0.0005
Accept								
Meal 1	0.00	21.50	36.50	46.00	91.00	34.10	17.95	0.26
Meal 2	0.00	17.50	30.00	40.00	77.00	29.80	18.02	p=0.010
Refuse								
Meal 1	0.00	3.00	7.00	13.00	84.00	11.02	14.04	0.37
Meal 2	0.00	3.00	7.00	15.00	74.00	11.15	12.44	p<0.0005
Reject								
Meal 1	0.00	0.00	1.00	2.50	13.00	1.95	2.92	0.24
Meal 2	0.00	0.00	1.00	4.00	22.00	2.69	4.15	p=0.018
Take off								
Meal 1	0.00	0.00	0.00	1.00	8.00	1.02	1.68	0.63
Meal 2	0.00	0.00	0.00	2.00	10.00	1.31	2.29	p<0.0005
Release								
Meal 1	0.00	0.00	3.00	5.00	25.00	3.81	4.59	0.48
Meal 2	0.00	0.00	3.00	6.00	19.00	3.71	4.22	p<0.0005
Model								
Meal 1	0.00	0.00	0.00	0.50	10.00	0.86	2.00	0.20
Meal 2	0.00	0.00	0.00	0.00	7.00	0.46	1.20	p=0.042

Table 6.3 shows that for each of the behavioural variables from the Inventory there is a statistically significant correlation across meals. However, the relationships are weak (i.e. ρ<0.30) for *give*, *hand*, *accept*, *reject* and *model*, and moderate (i.e. 0.30<ρ<0.70) for *feedself*, *refuse*, *takeoff* and *release*. The correlations suggest that while there is some stability in the behaviour of the mother and the child pairs across

meals, there is also within-subject (meal-to-meal) variability in behaviour, as one might expect.

The original variables were used to create new variables referred to as 'derived variables'. The derived variables summarise combinations of original variables. For example, one-year-olds can either accept food from their mother (*accept*) or feed themselves (*feedself*). The derived variable *bites* is calculated by summing the counts of *accept* and *feedself* to represent both the ways in which a child gets a mouthful of food. (A mouthful meaning 'food entering the child's mouth'; it does not refer to a quantity of food).

A child being fed by its mother can control its food intake by declining to eat the food the mother *gives* either by refusing food (*refuse*), or by spitting out food which has previously been accepted or self fed (*reject*). The derived variable *turndown* was calculated by summing the counts of *refuse* and *reject* to count all the occasions when the child made negative responses to food.

At the age of one year, the child is still partly feeding itself. The derived variable of *p.fdself(a)* was a measure of the proportion that the child fed itself rather than fed by the mother. The proportion *p.fdself(a)* is calculated by dividing the count of *feedself* by the sum of the counts of *feedself* and *give*. Another way of analysing self feeding was by calculating *p.fdself(b)*, a measure of the number of times the child feeds itself to the total number of bites the child takes in. It is calculated by dividing the count of *feedself* by the sum of the counts of *feedself* and *accept*.

In order to quantify the extent to which a mother facilitates self feeding rather than feeding the child directly themselves, the derived variable *p.hand(a)* can be calculated, by dividing the count of *hand* by the sum of counts of *hand* and *give*. The extent to which a child's self feeding is facilitated by the mother handing the child food can be measured by calculating *p.hand(b)*. This is the count of *hand* divided by the sum of the counts of *hand* and *feedself*.

The rationale for calculating the derived variable *p.accept* is that when it comes to actual feeding behaviour, the child only has two ways of controlling food intake. One way is to self feed: but some children are not capable of self feeding at this age and others may be discouraged from doing so. The other way of controlling intake is either to *accept* or *refuse* food that is given by someone else. The derived variable *p.accept* is the proportion of *gives* accepted. It is calculated by dividing the count of *accept* by the sum of the counts of *accept* and *refuse*.

The derived variables used in the analyses and the way in which they are calculated are summarised in Table 6.4.

Table 6.4 Descriptions and formulae for derived behavioural variables

Derived variable	Variable description	Variable calculated as
Bites	number of bites of food	(count of *feedself* + count of *accept*)
Turndown	number of negative responses to food	(count of *refuse* + count of *reject*)
P.fdself(a)	ratio of self feeding acts to number of self feeding acts and times mother puts food directly to child's mouth	$\frac{feedself}{(feedself + give)}$
P.fdself(b)	ratio of self feeding acts to number of times food enters child's mouth	$\frac{feedself}{(feedself + accept)}$
P.hand(a)	ratio of number of times mother places food in child's hand to number of times food is offered to child directly or indirectly	$\frac{hand}{(hand + give)}$
P.hand(b)	ratio of number of times mother places food in child's hand to number of times mother places food in child's hand and self feeding acts	$\frac{hand}{(hand + feedself)}$
P.accept	ratio of times food is accepted to number of times mother puts food directly to child's mouth	$\frac{accept}{(accept + refuse)}$

The distributions for the derived variables were inspected and as would be expected for count data, the distributions were positively skewed. Table 6.5 shows the descriptive statistics and correlation coefficients (Spearman's ρ) for the derived behavioural variables. All the correlations across meals for the variables were statistically significant. However the actual associations were weak (e.g. $\rho<0.30$) for the variables *bites, p.hand(a)* and *p.hand(b)*, and only moderate (e.g. $0.30<\rho<0.70$) for *turndown, p.fdself(a), p.fdself(b)* and *p.accept.* The results suggest that although there is some consistency across meals in behaviour within the individual pairs of mother and child, the degree of consistency is generally fairly low. This possibly reflects the fact that there are wide differences in the meals themselves (e.g. different foods are served, different levels of child hunger and so on) so that the weak to moderate strength of the correlations summarise the variety of behaviour and foods involved in meals.

Table 6.5 Percentiles, other descriptive statistics and correlation coefficients (Spearman's ρ) for derived behavioural variables

	Minimum	25th	Median	75th	Maximum	Mean	SD	Spearman's ρ
Bites								
Meal 1	6.00	43.50	58.00	71.00	174.00	59.77	25.39	0.20
Meal 2	17.00	40.50	61.00	80.50	131.00	63.37	26.37	p=0.050
Turndown								
Meal 1	0.00	0.00	9.00	14.50	90.00	12.97	14.54	0.38
Meal 2	0.00	5.00	10.00	19.00	74.00	13.84	13.14	p<0.0005
P.fdself(a)								
Meal 1	0.01	0.14	0.30	0.58	1.00	0.38	0.27	0.41
Meal 2	0.02	0.24	0.46	0.55	0.98	0.45	0.27	p<0.0005
P.fdself(b)								
Meal 1	0.02	0.18	0.34	0.66	1.00	0.43	0.28	0.45
Meal 2	0.03	0.30	0.53	0.67	1.00	0.52	0.28	p<0.0005
P.hand(a)								
Meal 1	0.00	0.00	0.00	0.03	1.00	0.05	0.16	0.24
Meal 2	0.00	0.00	0.01	0.12	0.50	0.08	0.12	p=0.016
P.hand(b)								
Meal 1	0.00	0.00	0.00	0.03	0.50	0.03	0.07	0.26
Meal 2	0.00	0.00	0.01	0.05	0.40	0.05	0.08	p=0.018
P.accept								
Meal 1	0.08	0.64	0.79	0.92	1.00	0.76	0 19	0.48
Meal 2	0.00	0.64	0.78	0.90	1.00	0.73	0.22	p<0.0005

Description of variables from the Verbal Coding Inventory

The verbal categories in the Verbal Coding Inventory describe comments made by the mother towards her child during the meals. For each participant, a count of occurrences coded under each category over the duration of the meal was made. There are two from each child, one from each meal.

The variables *mother's eating*, *food* (*negative*) and *offers of assistance* are not considered because they were shown to be unreliable and *untranscribable* because the variable carries no information. The distribution of scores for the remaining verbal variables were inspected and, as expected, were positively skewed. Table 6.6 shows the descriptive statistics and correlation coefficients (Spearman's ρ) for the verbal variables. Table 6.6 shows that the correlations for the verbal variables from meal-to-meal were all positive and statistically significant. The correlations were high for *food comments* (*positive*), *verbal offers* and *non-food* comments (e.g. $\rho \geq 0.70$) showing that there is a high degree of consistency in mother's verbal behaviour in these aspects. The correlations for *food comments* (*neutral*), *child eating behaviour* (*positive*, *negative* and *neutral*) and *child's condition* were moderate (e.g. $0.30 < \rho < 0.70$). The results show that while there is a statistically significant degree of consistency in mothers' verbal behaviour across the two meals, there is also within-subject variability in the way in which mothers talk to their children during meals, as one might expect.

Table 6.6 Percentiles, other descriptive statistics and correlation coefficients (Spearman's ρ) for the variables from the Verbal Coding Inventory

	Minimum	25th	Median	75th	Maximum	Mean	SD	Spearman's ρ
Food comments								
Positive								
Meal 1	0.00	3.00	10.50	21.50	63.00	14.07	13.69	0.70
Meal 2	0.00	3.00	9.00	19.50	68.00	13.22	13.64	$p<0.0005$
Neutral								
Meal 1	0.00	1.00	3.00	7.00	32.00	4.96	5.84	0.47
Meal 2	0.00	1.00	3.00	8.50	84.00	6.30	10.25	$p<0.0005$
Child eating behaviour								
Positive								
Meal 1	0.00	1.50	5.50	13.50	86.00	10.12	12.83	0.68
Meal 2	0.00	1.00	4.00	11.00	48.00	7.75	9.82	$p<0.0005$
Negative								
Meal 1	0.00	1.00	3.00	11.00	72.00	7.25	9.97	0.62
Meal 2	0.00	1.00	4.00	9.50	76.00	7.79	11.63	$p<0.0005$
Neutral								
Meal 1	0.00	7.00	15.00	22.00	58.00	16.02	11.43	0.56
Meal 2	0.00	6.00	13.00	23.00	60.00	16.55	13.35	$p<0.0005$
Verbal offers								
Meal 1	2.00	20.50	35.50	54.00	255.00	42.33	35.12	0.70
Meal 2	0.00	15.00	29.00	52.50	171.00	36.31	30.53	$p<0.0005$
Child's condition								
Meal 1	0.00	0.00	0.00	1.00	7.00	0.76	1.44	0.39
Meal 2	0.00	0.00	0.00	1.00	14.00	1.04	2.19	$p<0.0005$
Non-food comments								
Meal 1	0.00	15.50	36.00	58.50	195.00	46.08	42.68	0.78
Meal 2	0.00	14.00	30.50	64.00	302.00	45.40	48.23	$p<0.0005$

Chapter Seven

Results: Description of eating behaviour

Statistical procedures

The first purpose of this study was to provide information about children's eating behaviour in natural settings during the weaning stage of late infancy. The distributions of the variables used in the analyses were positively skewed (i.e. the majority of the scores were in the lower range of the scale) so, because the assumptions of parametric correlation were not met, all the correlation coefficients reported are from Spearman rank order correlations. Regression analyses do not assume that variables are normally distributed, though they do assume that residuals (measured – predicted values) are normally distributed, around a mean of zero. The assumption cannot be checked prior to the analysis and so is checked afterwards. This is done by examining (a) a histogram of the residuals or (b) a normal probability plot in which the points of a normal distribution lie on a straight line.

A series of examples of the histograms and normal probability plots referred to in this paragraph can be seen in Appendix Ten: Examples of standardised residuals to test assumption of regression methods. The assumption of regression methods is met in a regression of *intake* on *duration* and *bites* (discussed on page 140). The histogram in Figure A1 (in Appendix Ten) shows the distribution of residuals corresponds reasonably closely to the superimposed normal distribution. The normal probability plot in Figure A2 (in Appendix Ten) shows that the ordered residuals lie close to a straight line against their expected values form a normal distribution. An example in which the assumption is not met is the distribution of residuals from the regression of *bites* on *duration* (discussed on page 134). Figure A3 (in Appendix Ten) shows that the residuals are clearly positively skewed, i.e. more of the scores are low. Figure A4 (in Appendix Ten) shows that the ordered residuals do not lie on a straight line. Data of this kind can be transformed (usually to their square root or logarithm) so that they meet the assumption of the regression analysis. The same data but now from the regression of the logarithm of *bites* on *duration* are shown in a histogram and normal probability plot in Figures A5 and A6 respectively (in Appendix Ten). In these figures it can be seen that the residuals now conform to the assumptions of the regression analysis; the histogram corresponds to the superimposed normal distribution and the ordered residuals lie closely on a straight line.

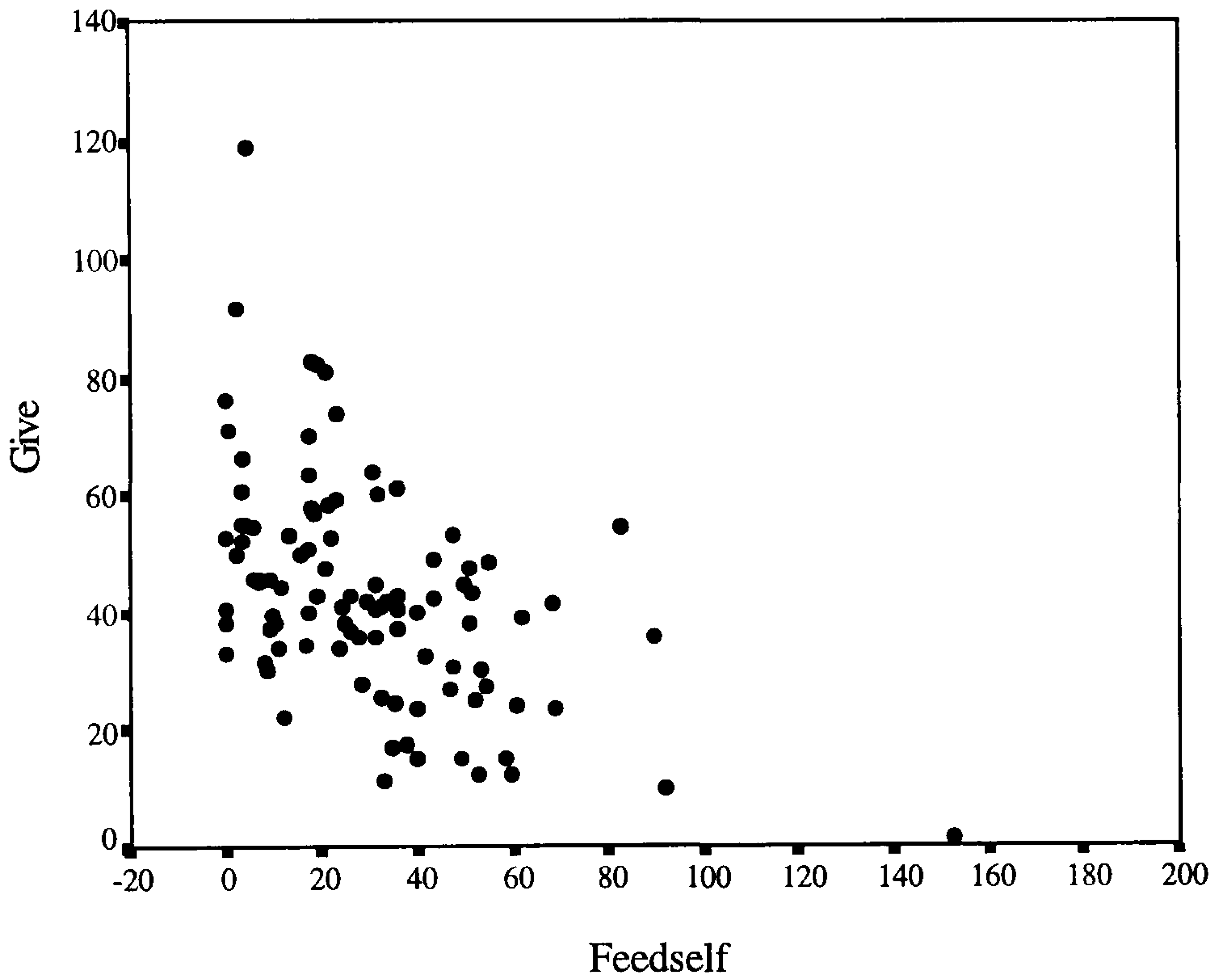
With data of this kind there is a conflict between simplicity of interpretation, which is easier if the data are not transformed, and exact tests of statistical significance, which require the data to be transformed so that the assumption of normality is met. Throughout the main body of this thesis the untransformed data are presented in the interests of simplicity of interpretation. In every case, however, where the assumption of normality is not met, the analyses using a square root or logarithmic transform has also been carried out as appropriate. In every case where a result is reported as statistically significant on the untransformed scale it is also statistically significant on the transformed scale.

Unless otherwise stated, all the mealtime variables used in the analyses comprise the mean of the scores from the two meals for each participant.

Description of eating behaviour

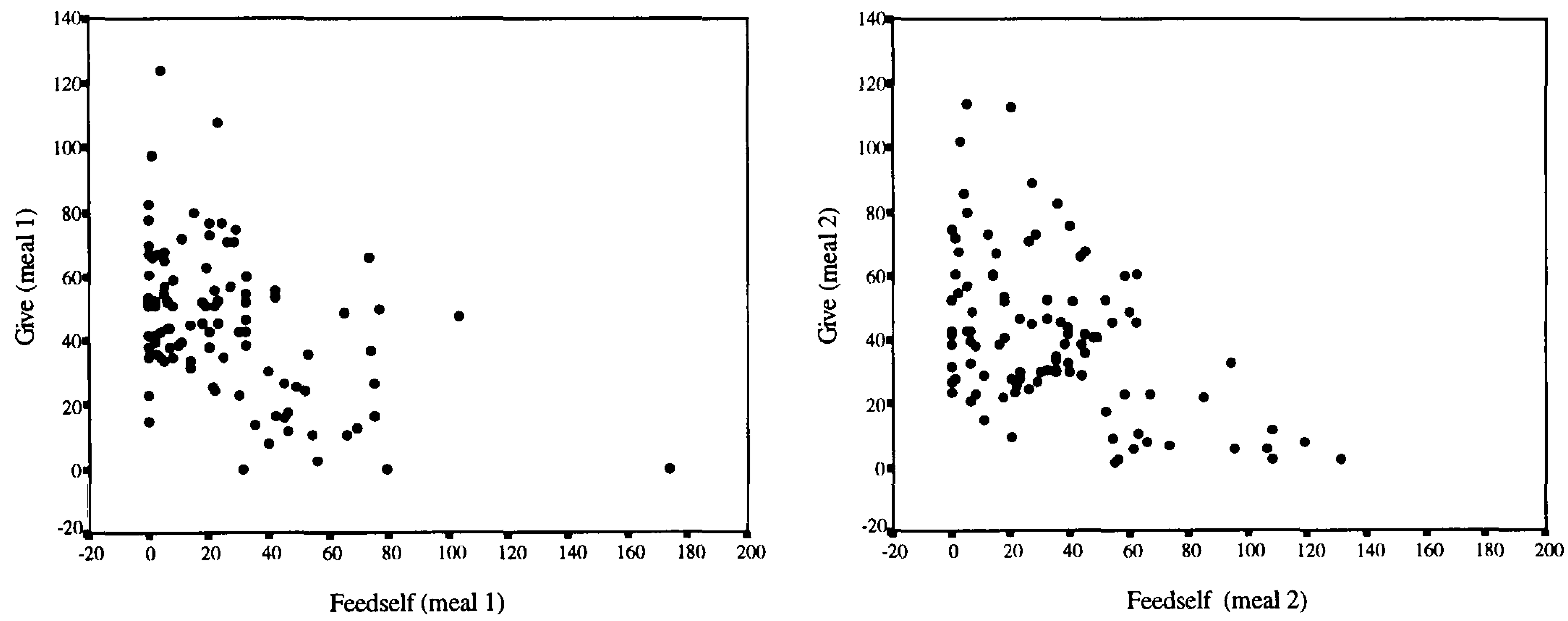
Food intake at a child's meal can occur in two ways; the child can either feed itself or be fed by its mother. How are these related? Figure 7.1 shows the relationship between *give* (the mother putting food directly to the child's mouth) and *feedself* (the child's attempts to feed itself).

Figure 7.1 Scatterplot showing the relationship between *give* and *feedself*



The linear correlation between the two is statistically significant ($\rho_{(100)}=-0.47$, $p<0.0005$) though as Figure 7.1 shows, the relationship is not entirely linear. The figure shows that children lie at both extremes of each variable, so that some are mostly fed by their mother (e.g. with a *feedself* score of 1.5 and a *give* score of 119.0) while others are almost entirely self feeding (e.g. with a *feedself* score of 152.5 and a *give* score of 1.5). The majority lie between these extremes showing that, in general, children of one year do attempt to feed themselves but nonetheless are still also fed by the mother. The negative correlation shows that the more a child feeds itself, the less the mother gives food to the child, and vice versa. Because the scores are means for two meals this suggests either (a) that each child is either entirely fed by their mother at one meal and entirely self feeding at the other, or (b) that there is a combination of being fed by the mother and self feeding at both meals. To distinguish between these, Figure 7.2 shows the relationship between *give* and *feedself* for meal 1 and the same relationship for meal 2.

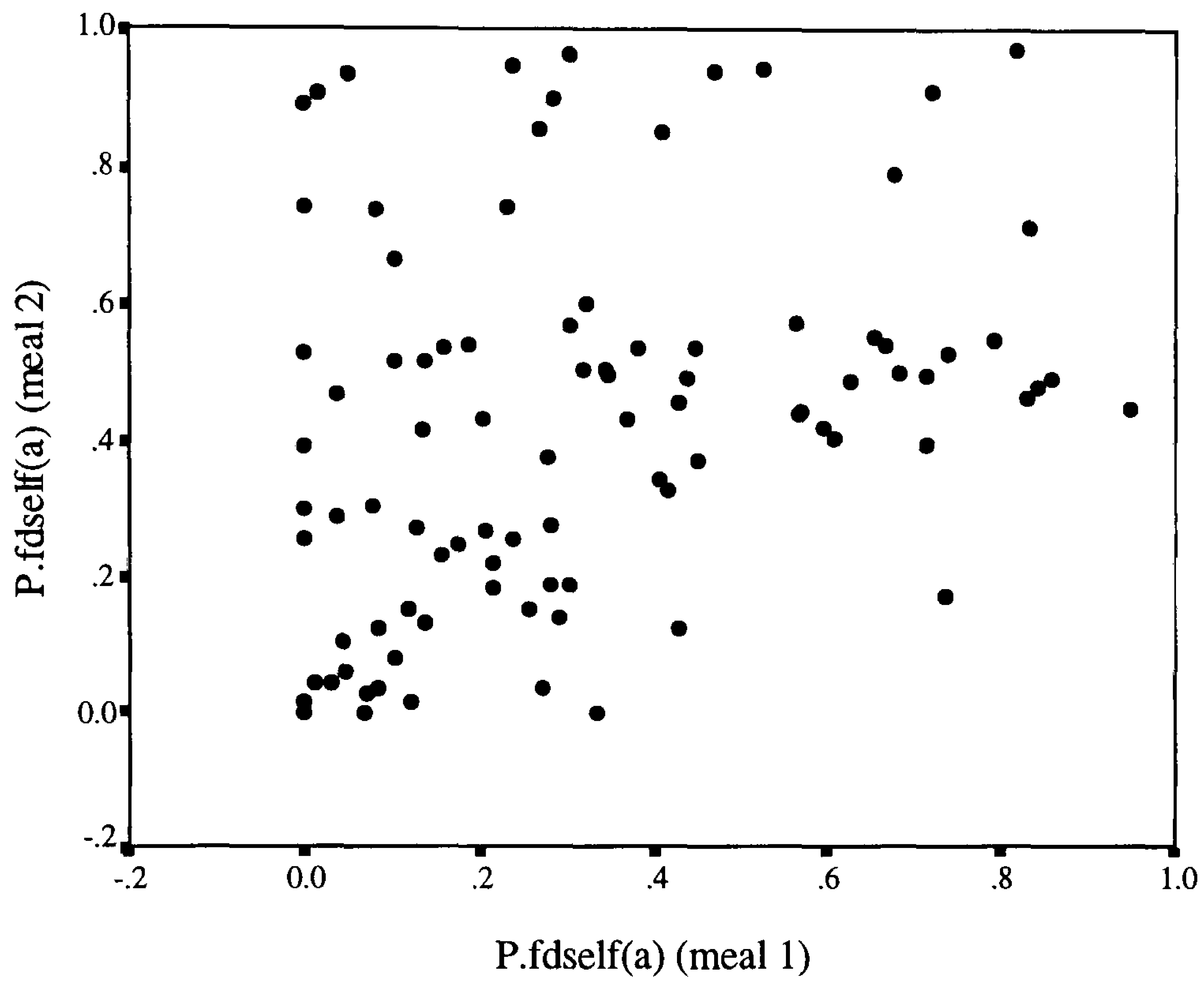
Figure 7.2 Scatterplot showing the relationship between *give* and *feedself* for meal 1 and meal 2



For each meal separately, the correlation coefficients between *give* and *feedself* are statistically significant: $\rho_{(100)}=-0.40$, $p<0.0005$ for meal 1 and $\rho_{(100)}=-0.40$, $p<0.0005$ for meal 2. From Figure 7.2 it can be seen that for many of the children, a combination of self feeding and being fed by the mother is found at each meal.

Although the above analysis shows that a combination of self feeding and being fed by the mother occurs for individual children at each meal, it does not show how consistently each individual child's feeding behaviour is over the two meals, i.e. whether the children who feeds themselves at one meal do so at the other. The derived variable *p.fdself(a)* is the ratio of *feedself* to *feedself* and *give*. The variables *feedself* and *give* together represent the total count of acts in which food can enter a child's mouth. Figure 7.3 shows the relationship between *p.fdself(a)* over meal 1 and meal 2.

Figure 7.3 Scatterplot showing the relationship between *p.fdself(a)*, for meal 1 and meal 2



Although the relationship appears weak, the correlation between *p.fdself(a)* for meal 1 and meal 2 is statistically significant ($\rho_{(100)}$=0.41, p<0.0005), showing that there is some consistency across the meals; a child feeding itself at one meal tends to do so at the other, and a mother who feeds her child tends to do so at both meals. However, Figure 7.3 shows that there are a few scores showing that there are some children who are entirely fed by the mother at one meal and always self feed at the other. This finding emphasises the importance of observing more than one meal, because for some children information from one meal may not be a good representation of their feeding behaviour.

An alternative way of measuring the child's self feeding behaviour is to calculate *p.fdself(b)*, the ratio of *feedself* to *feedself* and *accept*. This ratio shows the proportion of times food enters the child's mouth from self feeding, rather than accepting food from the mother. Figure 7.4 shows the distribution of scores for *p.fdself(b)*.

Figure 7.4 Histogram showing the distribution of scores for *p.fdself(b)*

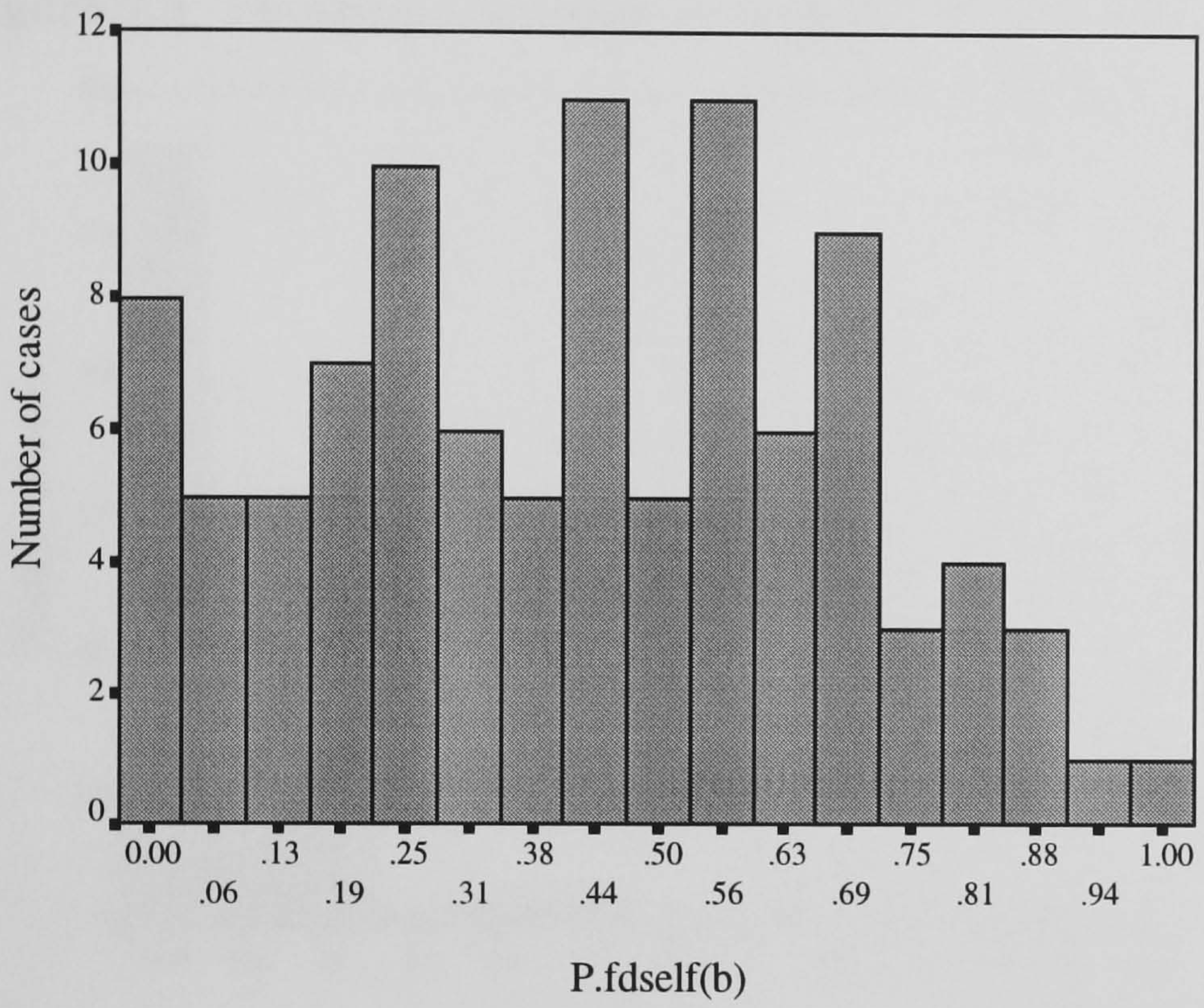


Figure 7.4 shows that, when examining how a child takes in a mouthful of food, as one would expect from the last analyses, a few take in all their food directly from the mother and a few are feeding independently. However, the distribution is roughly flat so that for children of this age self feeding takes place in widely varying proportions.

As well as giving a child food directly (*give*) a mother may facilitate the child's self feeding by handing food to her child (*hand*). As one would expect, therefore, there is a correlation between *hand* and *feedself* ($\rho_{(100)}$=0.37, p<0.0005). There is also a slight negative correlation between *hand* and *give* ($\rho_{(100)}$=–0.20, p<0.05), i.e. mothers who *hand* food to the child less, *give* food directly more. *P.hand(a)*, the ratio of *hand* to *hand* and *give*, can be calculated. This expresses the extent to which a mother facilitates the child's self feeding by handing the child food rather than feeding the child directly themselves. The distribution of scores for *p.hand(a)* are shown in Figure 7.5.

Figure 7.5 Histogram showing the distribution of scores for *p.hand(a)*

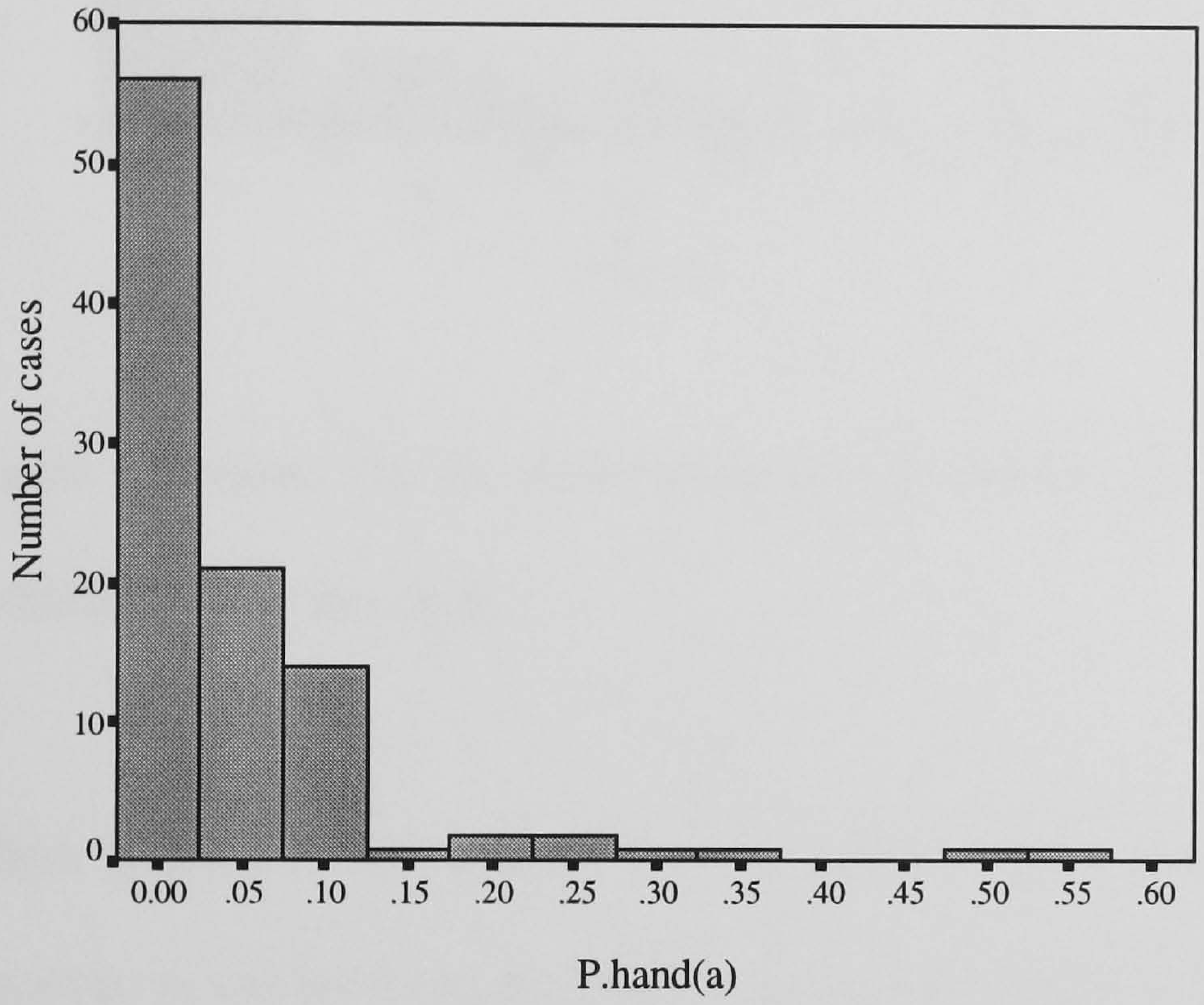


Figure 7.5 shows that for the majority of children, mothers *give* food directly rather than *hand* food to the child to facilitate self feeding.

P.hand(b), the ratio of *hand* to *hand* and *feedself*, can also be formed. This ratio expresses the extent to which a mother facilitates the child's self feeding by handing food to the child. Figure 7.6 shows the distribution of scores for *p.hand(b)*.

Figure 7.6 Histogram showing the distribution of scores for *p.hand(b)*

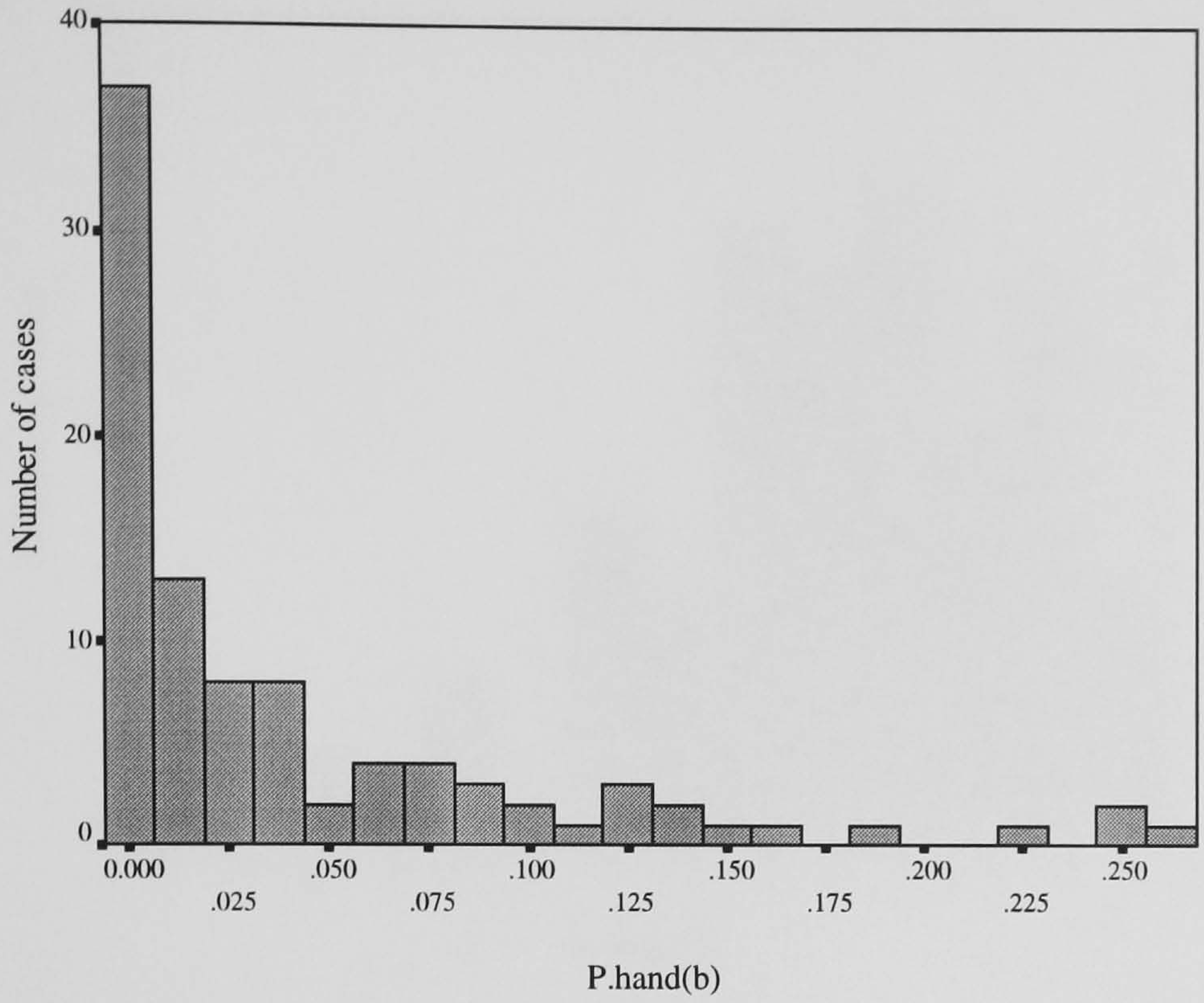
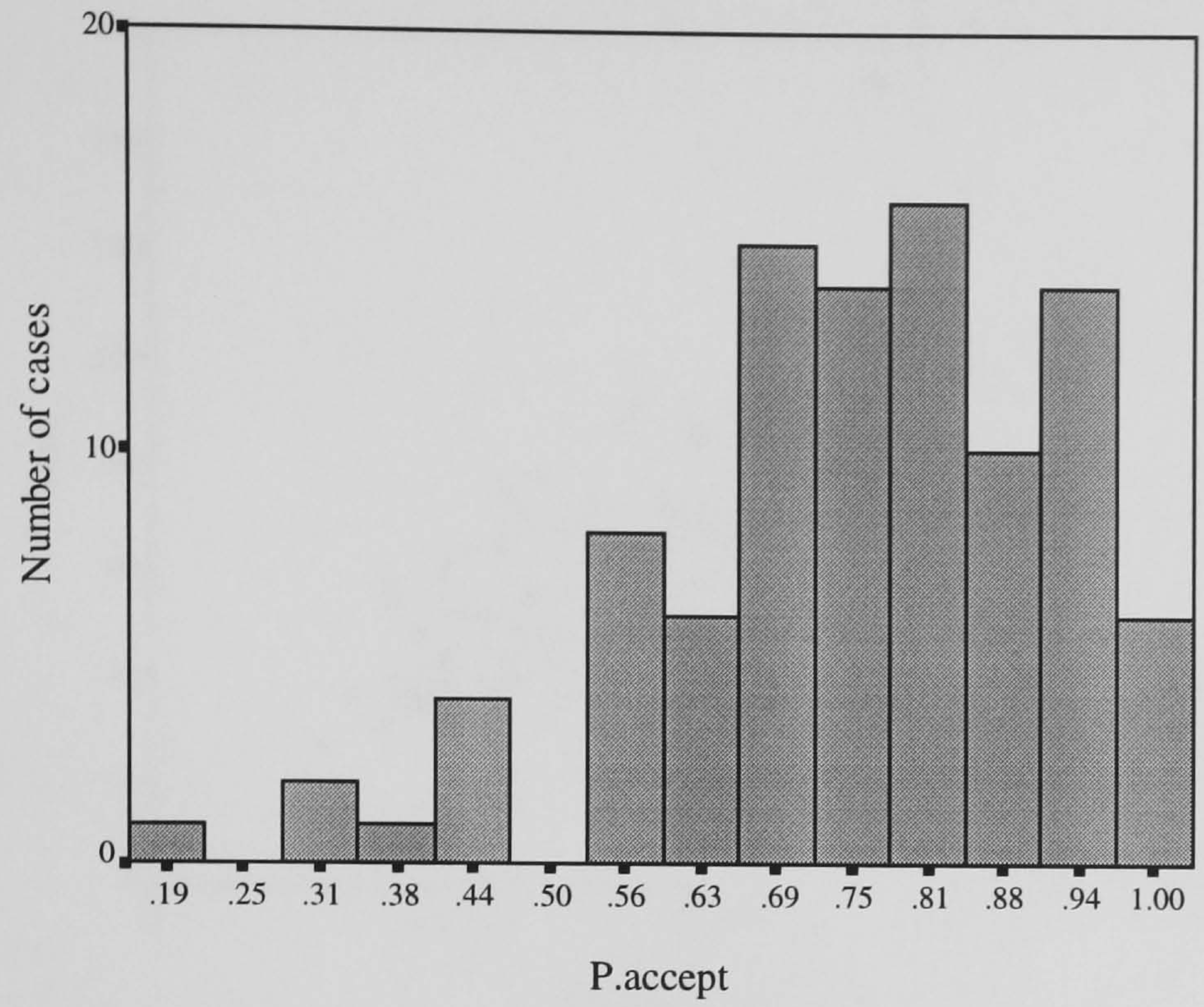


Figure 7.6 shows that for many children, the mother did not facilitate self feeding by handing food to the child.

When a child is fed directly by the mother rather than feeding itself, the child's response to the food can be either to *accept* or *refuse* it. The ratio of *accept* to *accept* and *refuse* (*p.accept*) expresses the extent to which a child accepts food rather than refuses it. It is, however, only meaningful for children who are fed directly by the mother to some extent. Figure 7.7 shows the distribution of scores for *p.accept*: the majority of children *accept* food more than they *refuse* it. A very few refuse food many more times than they accept it, and there are others who do not refuse food from the mother at all.

Figure 7.7 Histogram showing the distribution of scores for *p.accept*



Because consumption of food is the most important function of a child's meal, it would be expected that a meal would continue only as long as the child continues to eat. One-year-olds can either be fed by their mother or feed themselves, and the derived variable *bites* was calculated to represent both the ways in which a child can actually consume food during a meal. *Bites* is the sum of the counts of *accept* and *feedself*. Figure 7.8 shows the relationship between *bites* and *duration*. The correlation is statistically significant ($\rho_{(100)}=0.63$, $p<0.0005$). In order to quantify this relationship, the regression of *bites* on *duration* was examined. The results can be seen in Table 7.1 which shows that on average in a short meal of 10 minutes duration a child takes 46 bites ($28.96 + 1.73*10 = 46.26$). For every additional minute another 2 bites (1.73) are taken.

Figure 7.8 Scatterplot showing the relationship between *bites* and *duration* (mins)

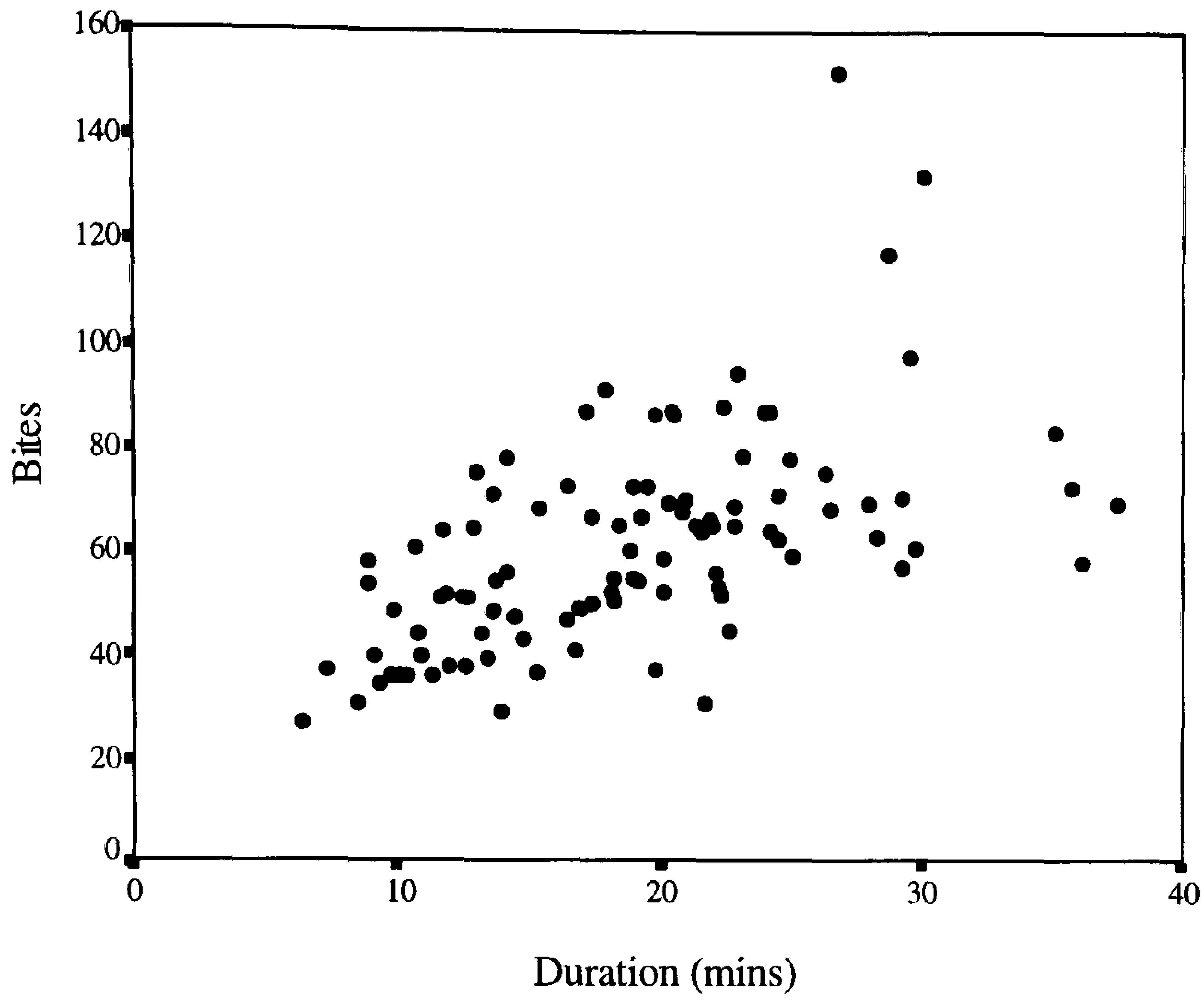


Table 7.1 Regression of *bites* on *duration* (mins)

		B	SE B	*t*	*p*
Constant		28.96	5.07		
Duration		1.73	.25	6.85	.0000
Analysis of Variance					
	DF	Sum of squares	Mean square	*F*	*p*
Regression	1	14006.88	14006.88	46.89	.0000
Residual	98	29276.13	298.74		
Total	99	43283.01			
Multiple R		.57			
R square		.32			
Adjusted R square		.32			
Standard error		17.28			

While predicting the number of bites from meal duration is of interest, of equal interest is predicting meal duration from the number of bites taken. Table 7.2 shows the results from the regression of *duration* on *bites*.

Table 7.2 Regression of *duration* (mins) on *bites*

		B	SE B	*t*	*p*
Constant		7.34	1.77		
Bites		.19	.03	6.847	.0000
Analysis of Variance					
	DF	Sum of squares	Mean square	*F*	*p*
Regression	1	1515.74	1515.74	46.89	.0000
Residual	98	318.08	32.33		
Total	99	1833.82			
Multiple R		.57			
R square		.32			
Adjusted R square		.32			
Standard error		5.69			

Table 7.2 shows that for a meal during which a child takes 60 bites, for example, the average duration of the meal is 19 minutes ($7.34 + 0.19*60 = 18.74$) and a further 11 seconds (.19 minutes) for each extra bite.

It would be reasonable to expect that a child learning to feed itself would take longer over a meal than when the child is being fed by its mother - the task for the child in the latter case is whether or not to accept the food, but does not have the difficulty of manipulating the food, getting the food to its mouth and so on. Regression was used to determine the separate relationships between *duration*, *accept* and *feedself*, rather than using the two variables combined into the derived variable *bites*. The results from the regression can be seen in Table 7.3.

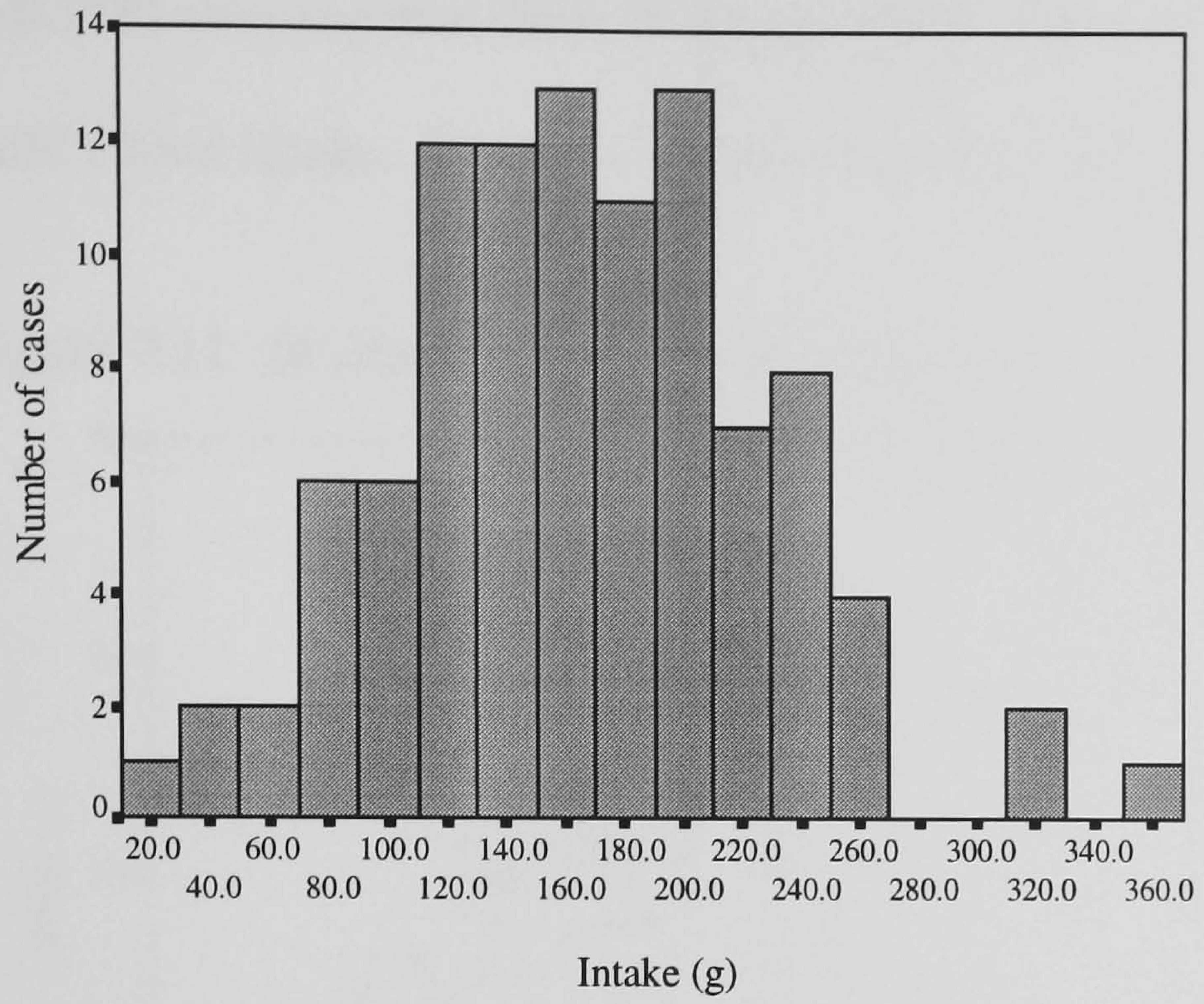
Table 7.3 Regression of *duration* (mins) on *accept* and *feedself*

		B	SE B	*t*	*p*
Constant		9.09	2.06		
Accept		.13	.05	2.84	.0055
Feedself		.19	.03	7.03	.0000
Analysis of Variance					
	DF	Sum of squares	Mean square	*F*	*p*
Regression	2	1600.23	800.11	25.17	.0000
Residual	97	3083.59	31.79		
Total	99	4683.82			
Multiple R		.58			
R square		.34			
Adjusted R square		.33			
Standard error		5.64			

Table 7.3 shows that the relationship between *duration* and *accept* is statistically significant and so is that between *duration* and *feedself*. The variable *feedself* was associated with a slightly slower rate of feeding than the variable *accept* in that for every count of *feedself* the meal lasted approximately 11 seconds (0.19 minutes) longer on average, and for every count of *accept* the meal lasted approximately 8 seconds (0.13 minutes) longer. From this analysis, it can be concluded that self feeding is a somewhat slower process than accepting food from the mother.

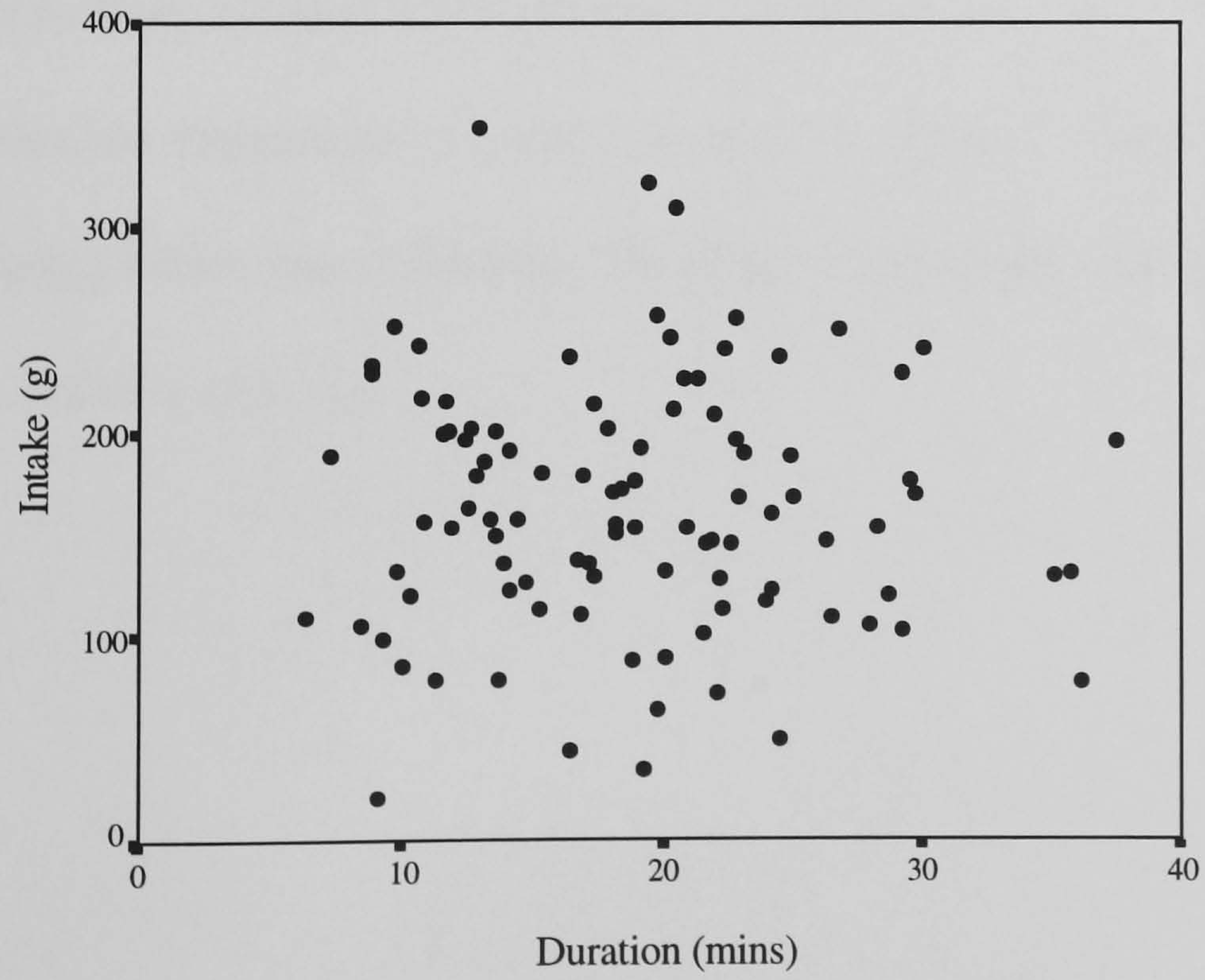
The variable *intake* is a measure of the weight of food eaten (in grams) and Figure 7.9 shows its distribution. The distribution is roughly normal with a few children eating very little over the two meals and a few eating much more. The majority of children lie somewhere between the two extremes.

Figure 7.9 Histogram showing the distribution of scores for *intake* (g)



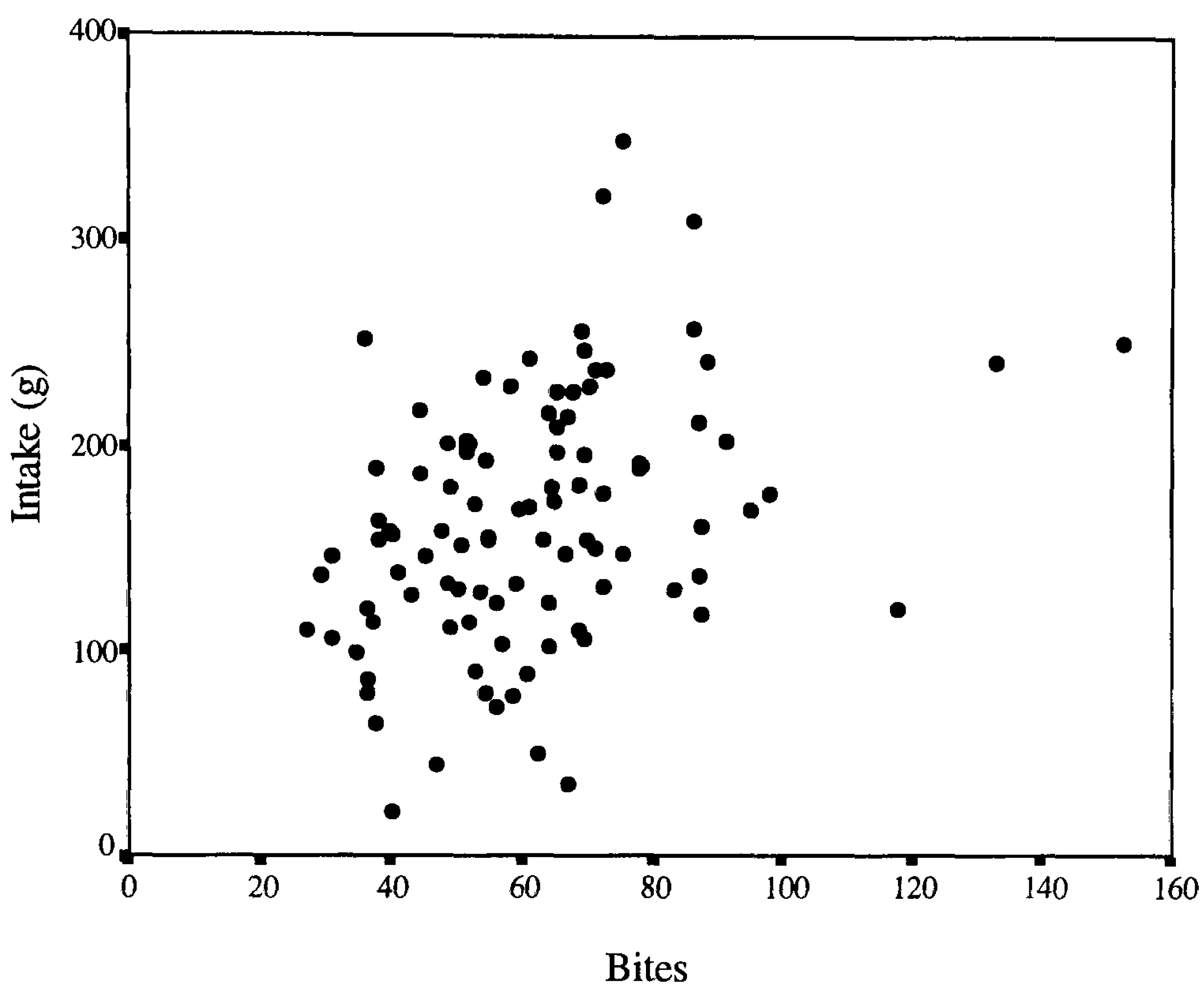
Having established that *bites* and *duration* are positively related, the next analyses examined whether these variables were related to food intake. Figure 7.10 shows the relationship between *intake* and *duration*.

Figure 7.10 Scatterplot showing the relationship between *intake* (g) and *duration* (mins)



The relationship between *intake* and *duration* is non-significant ($\rho_{(100)}=-0.03$, $p=0.758$) showing that there is no association between the length of a meal and the child's food intake. Figure 7.11 shows the relationship between *intake* and *bites*.

Figure 7.11 Scatterplot showing the relationship between *intake* (g) and *bites*



Intake was clearly related to *bites* ($\rho_{(100)}=0.39$, $p<0.0005$). Figure 7.11 shows that the more bites of food the child takes in, the greater the child's food intake. The results from the regression of *intake* on *bites* in Table 7.4 show that on average in a meal during which the child takes 60 bites, for example, 163 grams are taken in (96.71 + 1.11*60 = 163.31).

Table 7.4 Regression of *intake* (g) on *bites*

		B	SE B	*t*	*p*
Constant		96.71	17.86		
Bites		1.11	.27	4.03	.0001
Analysis of Variance					
	DF	Sum of squares	Mean square	*F*	*p*
Regression	1	52940.61	52940.61	16.20	.0001
Residual	98	320227.00	32667.62		
Total	99	373167.61			
Multiple R		.38			
R square		.14			
Adjusted R square		.13			
Standard error		57.16			

It has been shown that the relationship between *intake* and *duration* is not significant, whereas that between *intake* and *bites* is significant and positive. The regression of *intake* on *duration* and *bites* examined the relationship between these variables simultaneously. The results are shown in Table 7.5. The relationship between *intake* and *bites* is statistically significant and so is the relationship between *intake* and *duration.* The former is a positive relationship whereas the latter is a negative one. This shows that food intake goes up with the number of bites taken, but given a fixed number of bites, intake decreases the longer the meal lasts.

Table 7.5 Regression of *intake* (g) on *duration* (mins) and *bites*

		B	SE B	*t*	*p*
Constant		120.35	18.42		
Duration		−3.22	.97	−3.42	.0012
Bites		1.71	.32	5.37	.0000
Analysis of Variance					
	DF	Sum of squares	Mean square	*F*	*p*
Regression	2	85829.88	42914.69	14.49	.0000
Residual	97	287338.23	2962.25		
Total	99	373168.11			
Multiple R		.47			
R square		.23			
Adjusted R square		.21			
Standard error		54.43			

Table 7.6 shows the expected (mean) value [E(Y)] of *intake* for illustrative values of *duration* and *bites* for average meals: the 25th, 50th and 75th centiles of these variables for the two meals combined, rounded to the nearest whole number were used. The relationship is shown graphically in Figure 7.12.

Table 7.6 Expected (mean) value [E(Y)] of *intake* (g) against 25th, 50th and 75th centile values of *duration* (mins) and *bites*

Bites	**Response: *intake* in grams**		
49	162	143	130
60	181	162	149
71	200	181	168
Duration	**13**	**19**	**23**

Figure 7.12 Graph showing *intake* (g) for 25th, 50th and 75th centile values of *duration* (mins) and *bites*

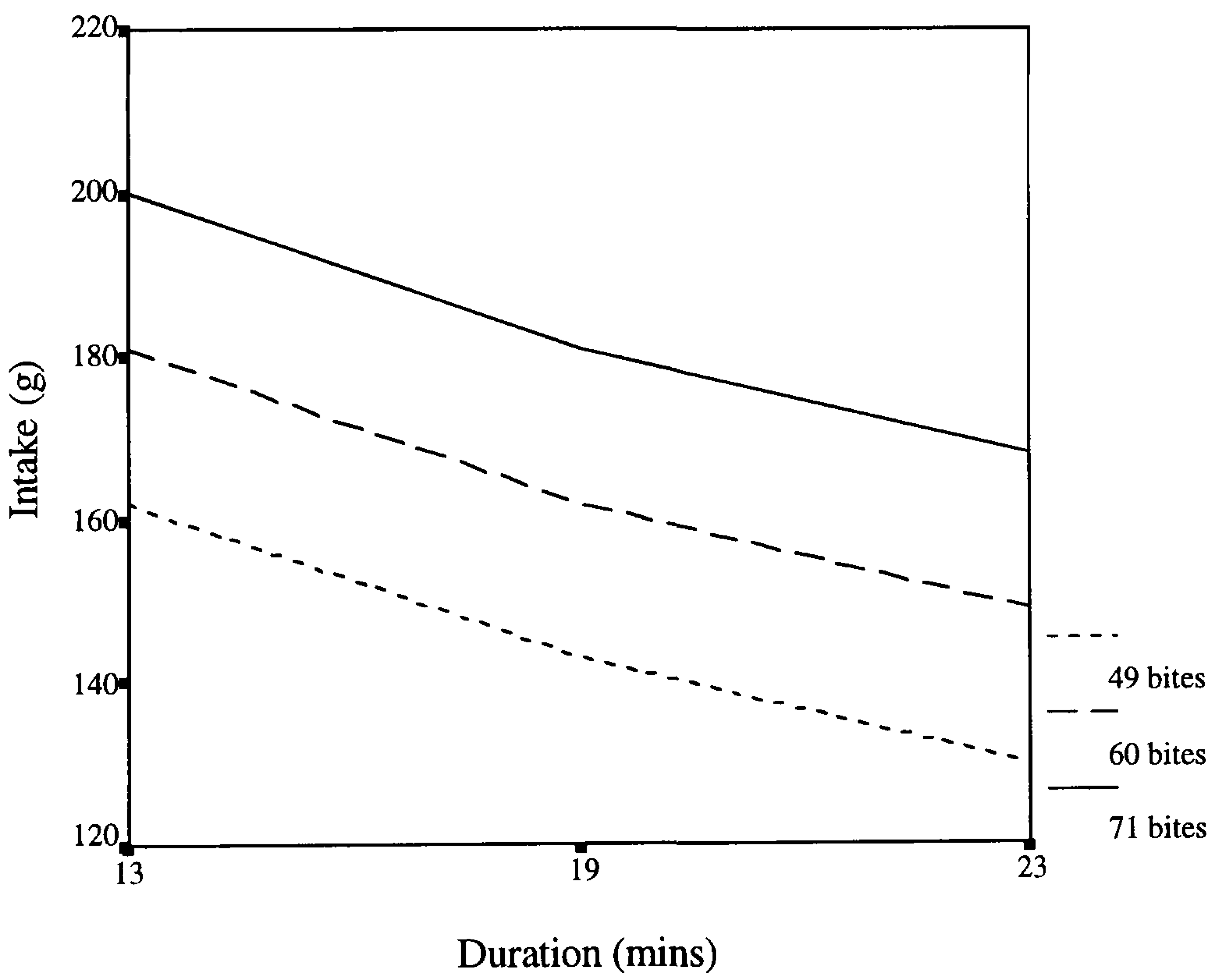


Table 7.6 shows the increase in *intake* as more *bites* are taken for a meal of a given *duration*, and also the decrease in *intake* as the *duration* of the meal increases for a given number of *bites*. This is illustrated in Figure 7.12. The analysis shows that longer meals are associated with more bites, but less food is taken in per bite.

The derived variable *bites* is made up of two original variables: *accept* and *feedself*. Because one-year-olds are still learning to feed themselves, it was important to determine whether the relationships between *intake* and *feedself*, and that between *intake* and *accept* differs. The relationships between *intake*, *accept* and *feedself* were examined and the results are shown in Table 7.7.

Table 7.7 Regression of *intake* (g) on *accept* and *feedself*

		B	SE B	t	p
Constant		25.70	15.83		
Accept		3.49	.35	10.08	.0000
Feedself		.93	.21	4.46	.0000
Analysis of Variance					
	DF	Sum of squares	Mean square	F	p
Regression	2	191610.43	95805.22	51.19	.0000
Residual	97	181557.18	1871.72		
Total	99	373167.61			
Multiple R		.72			
R square		.51			
Adjusted R square		.50			
Standard error		43.26			

The regression in Table 7.7 shows that the relationship between *intake* and *accept* is statistically significant; during a meal where the child accepts food, say 30 times, on average 130 g (25.70 + 3.49*30 = 130.40) are taken in; for every further count of *accept* an extra 3 g (3.49) are taken in. The relationship between *intake* and *feedself* is also statistically significant. In this case during a meal where the child feeds itself, say 30 times, on average 54 g (25.70 + .93*30 = 53.60) are taken in; for every further count of *feedself* an extra 1 g (0.93) is taken in. The coefficient from the variable *feedself* is a measure of the child's attempts to feed itself, and as the children were still learning the skills of self feeding with solids, it would not be expected that their attempts to self feed would be as successful as the mother's attempts to feed her child. These results suggest that at this age the most effective way of getting food into the child's mouth is for the mother to feed the child.

Having established that these relationships exist for the meals overall, the next analysis determined whether they existed for both meals when analysed separately. Table 7.8 shows the coefficients from the regressions of *intake* on *accept* and *feedself* separately, for meal 1 and meal 2.

Table 7.8 Coefficients from the regressions of *intake* (g) on *accept* and *feedself*, for meal 1 and meal 2

	Meal 1			**Meal 2**		
	B	**SE B**	*p*	**B**	**SE B**	*p*
Constant	31.64	14.26		35.17	14.64	
Accept	3.50	.30	.0000	3.18	.33	.0000
Feedself	.88	.20	.0000	.79	.19	.0000

Table 7.8 shows that in splitting the meals up and analysing *intake* with *accept* and *feedself* separately for each meal, the results are very similar for the two meals showing that these estimates are replicable, at least across meals within the same group of children.

The last analysis showed that intake is higher when the mother feeds the child, and it was shown earlier that food intake goes up with the number of bites taken, but given a fixed number of bites, intake decreases the longer the meal lasts (page 140). The next analysis examined *intake* and *duration* and their relationship with the child being fed by the mother and with the child feeding itself. Table 7.9 shows the results of the regression of *intake* on *accept, feedself* and *duration.*

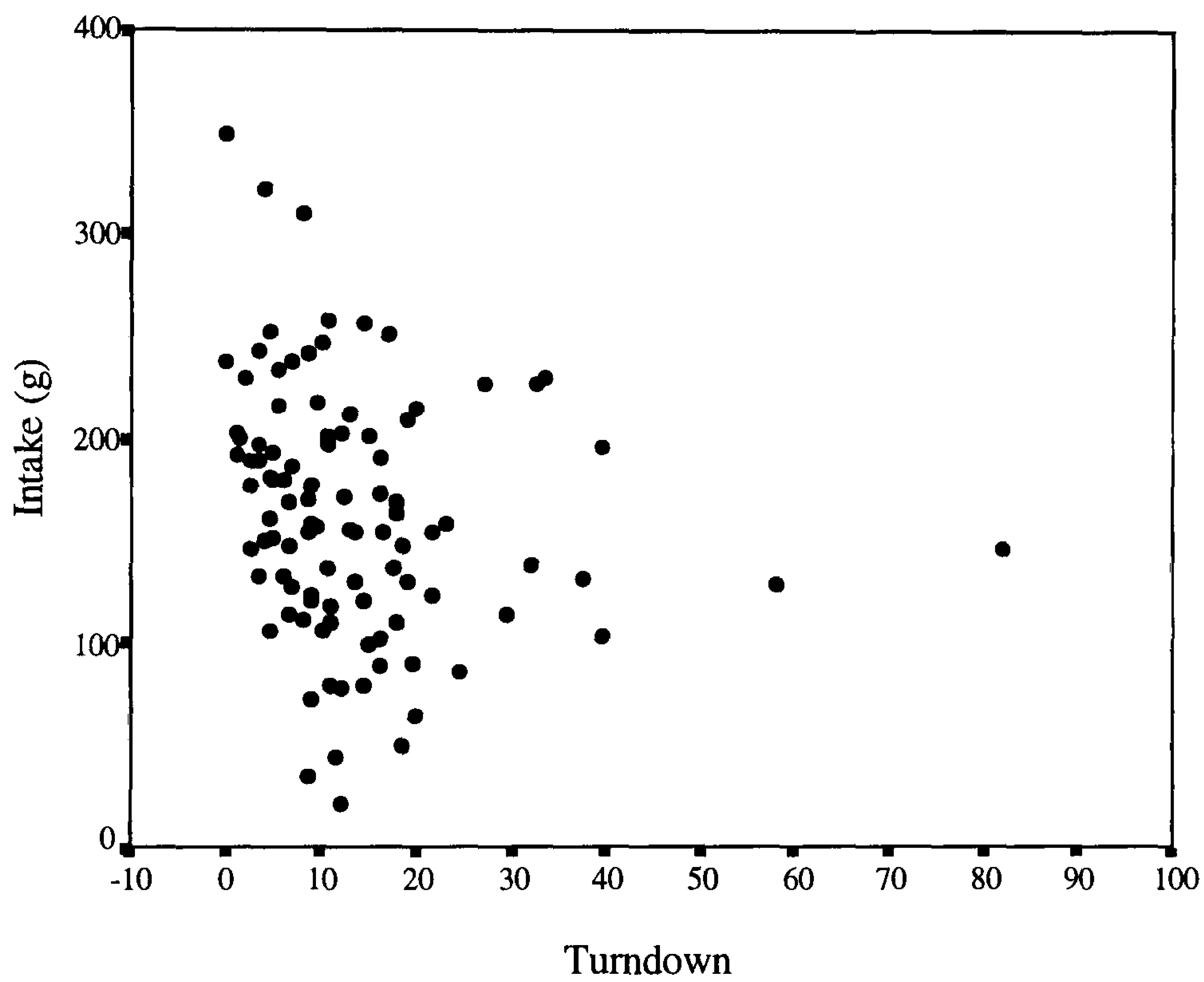
Table 7.9 Regression of *intake* (g) on *accept, feedself* and *duration* (mins)

		B	SE B	*t*	*p*
Constant		45.69	16.70		
Accept		3.77	.35	10.87	.0000
Feedself		1.35	.25	5.47	.0000
Duration		−2.20	.75	−2.93	.0042
Analysis of Variance					
	DF	Sum of squares	Mean square	*F*	*p*
Regression	3	206538.34	68846.11	39.66	.0000
Residual	96	166629.27	1735.72		
Total	99	373167.61			
Multiple R		.74			
R square		.55			
Adjusted R square		.54			
Standard error		41.66			

Table 7.9 shows that, for example, in a short meal of 10 minutes with an *accept* count of 20, *intake* is 99.0 g [45.69 + (-2.20*10) + (3.77*20) = 99.09], whereas for a *feedself* count of 20, *intake* is 50.7 g [45.69 + (-2.20*10) + (1.35*20) = 50.69]. This analysis shows that for a meal of a given *duration*, *intake* is much higher for a given number of *accepts* than for a given number of *feedself.*

The variables *accept* and *feedself* have been shown to be positively related to *intake*; and one might expect when the child turns down food that this behaviour would be negatively related to *intake*. Turning down food can occur in two ways: either the child refuses the food the mother *gives*, or the child *rejects* (spits out) food which is already in its mouth. The derived variable *turndown*, the sum of the counts of *refuse* and *reject*, was calculated to combine these actions. Figure 7.13 shows the relationship between *intake* and *turndown*.

Figure 7.13 Scatterplot showing the relationship between *intake* (g) and *turndown*



The negative relationship between *turndown* and *intake* was statistically significant ($\rho_{(100)}$=−0.31, p=0.002) showing that the lower the child's food intake the more often the child refused or rejected food. This relationship was examined taking the variable *give* into account, because the number of times a child *refuses* or *rejects* food is determined to an extent by the number of times the mother *gives* food. Table 7.10 shows the results from the regression of *intake* on *turndown* and *give*.

Table 7.10 Regression of *intake* (g) on *turndown* and *give*

		B	SE B	*t*	*p*
Constant		100.69	11.89		
Turndown		−3.31	.48	−6.84	.0000
Give		2.51	.31	8.13	.0000
Analysis of Variance					
	DF	Sum of squares	Mean square	*F*	*p*
Regression	2	159980.13	79990.07	36.40	.0000
Residual	97	213187.48	2197.81		
Total	99	373167.61			
Multiple R		.65			
R square		.43			
Adjusted R square		.42			
Standard error		46.88			

Table 7.10 shows that when the number of times the mother *gives* is taken into account, the relationship between *intake* and *turndown* is statistically significant; the child's food intake is lower as more food is refused and rejected. The relationship between *intake* and *give* is also statistically significant, although in this case the relationship is a positive one. This shows that food intake goes up with the number of *gives*, but for a given count of *give*, food intake decreases the more the child refuses and rejects food. Table 7.11 shows the expected (mean) value [E(Y)] of *intake* for illustrative example values of *turndown* and *give*: the 25th, 50th and 75th centiles for the two meals combined, rounded to the nearest whole number were used. The relationship is shown graphically in Figure 7.14.

Table 7.11 Expected (mean) value [E(Y)] of *intake* (g) against 25th, 50th and 75th centile values of *turndown* and *give*

Turndown	Response: *intake* in grams		
6	164	184	214
11	147	167	197
17	127	147	177
Give	**33**	**41**	**53**

Figure 7.14 Graph showing *intake* (g) for 25th, 50th and 75th centile values of *turndown* and *give*

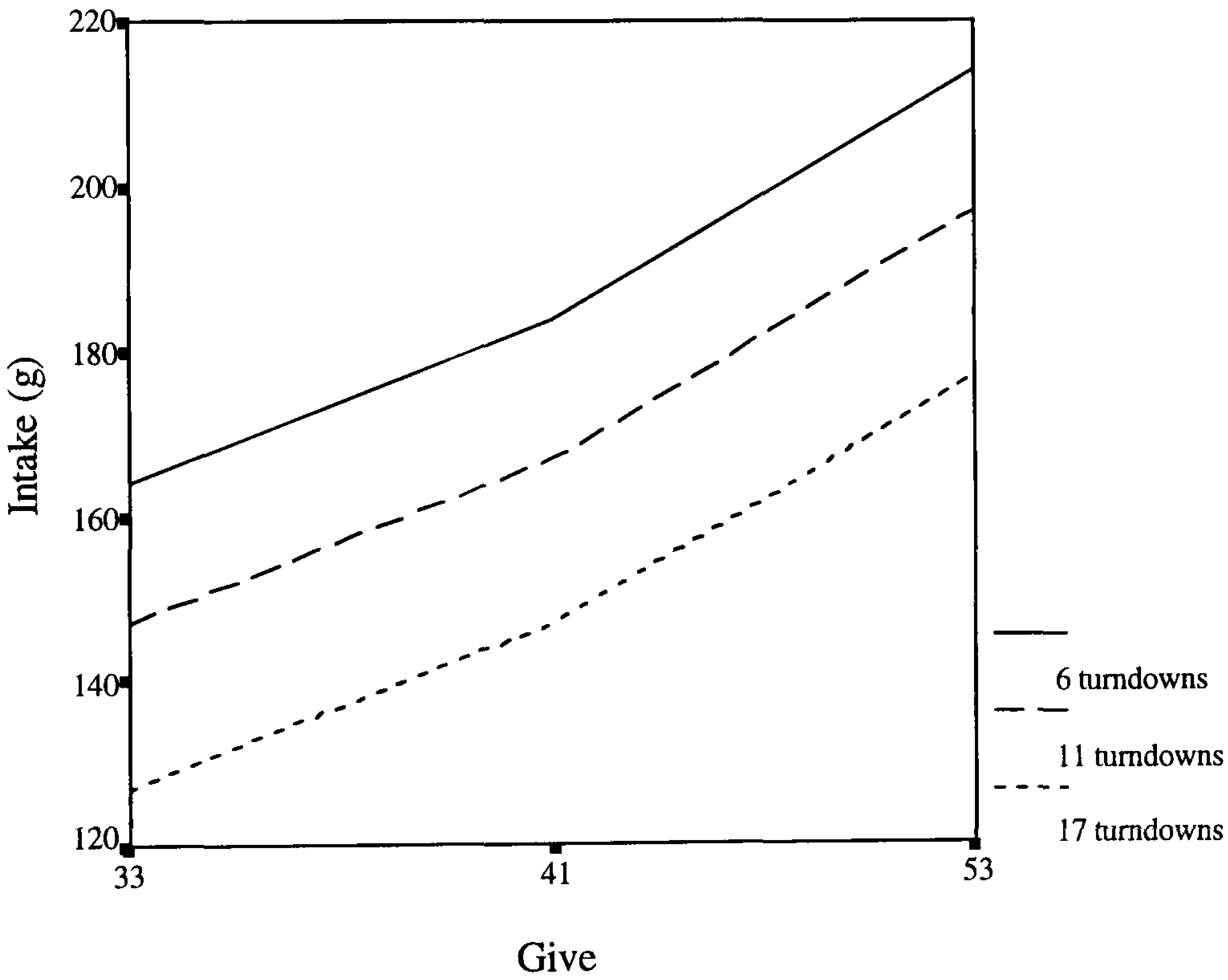


Table 7.11 and Figure 7.14 show the increase in expected *intake* as the child *refuses* and *rejects* food less for a given number of *gives*. They also show the increase in *intake* as the number of times the mother *gives* increases for a given number of *turndowns*.

The fact that children turn down food at all suggests that there is often food left uneaten when the meal is finished. The variable *leftover* is the amount of food uneaten by the child at the end of the meal and Figure 7.15 shows the distribution of food left uneaten in grams for the two meals.

Figure 7.15 Histogram showing the distribution of scores for *leftover* (g)

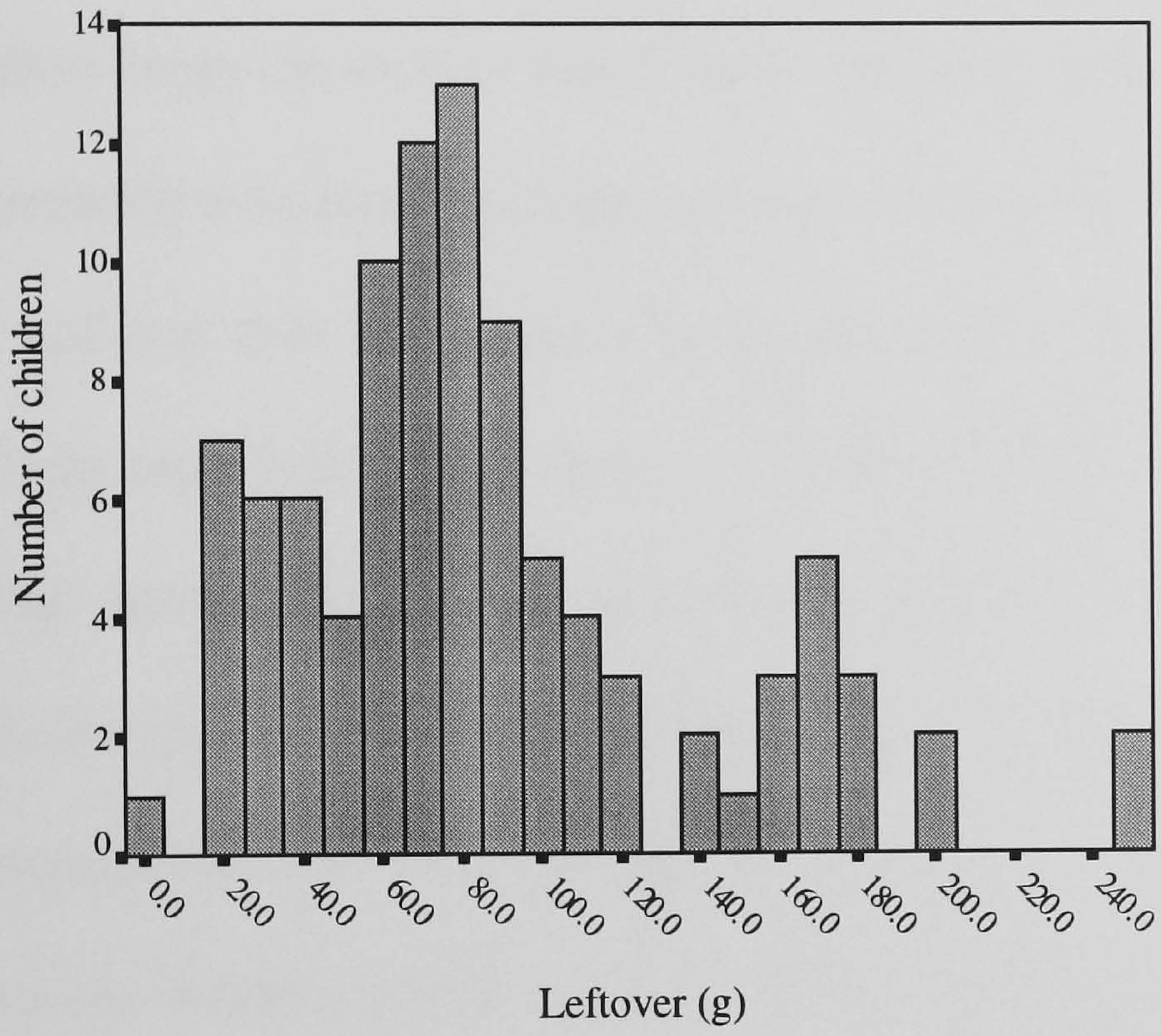


Figure 7.15 shows that only one child left no food uneaten at both meals. All the others left food at the end of the meals and some left a substantial amount. This suggests that children exert control over their food intake, at least in the sense that they do not passively eat all the food offered to them.

Savoury and sweet food eating behaviour

There is evidence that infants have an innate preference for sweet tastes which remains constant throughout childhood (Cowart, 1981). Sugars provide energy and increase the palatability of foods given at weaning (Weaning and the Weaning Diet Report, Department of Health, 1994). The same report goes on to say that most infants enjoy the taste of sweet foods and 'may reject savoury food if they know that eventually a dessert, which they prefer, will be given'. This report is based on sources of national data (Department of Health and Social Security, 1975; Martin, 1978; Martin and Monk, 1982; Martin and White, 1988; White et al., 1992; Mills and Tyler, 1992) comprising surveys conducted on infants and young children. These surveys afford a general picture of the types of foods that are offered to young children and the amounts they eat. The next section investigates the actual eating behaviour of one-year-old children in relation to the taste of food.

When coding the meals, at the beginning of each coding session, the codes for the type of food (savoury or sweet) and its texture (*solid*, *semi-solid* or *purée*) were entered. This was followed by a continuous sequence of codes for method of feeding (spoon or finger) then behaviours (e.g. *give* then *accept*) until the type of food being offered to the child changed. At this point, the code for the new type of food was entered and the coding continued as before. It was possible to add another code to every single original code in each of the data files at a later stage according to whether it belonged to the savoury or sweet section of the meal. The files were run sequentially through an SPSS command file which split each data file into two according to the type of food being eaten. The next section of analyses was computed to determine differences in eating behaviour according to whether the child was eating a savoury or sweet food.

Of the whole sample, two children were not served any savoury food during one of the meals and nineteen children were not served any sweet food during one of the meals (two of them were not served any sweet food during either of the meals). In cases where one type of food only was served at a meal, the counts for each variable for that type of food at that meal were computed and the variables for the other type of food were classified as missing data in the analyses. In all other cases the analyses computed the mean of the scores from the two meals for each participant for the savoury and sweet sections of the meal separately unless otherwise stated.

The majority of the children were served a savoury course first, which was followed by a dessert. However, a few children were fed both savoury and sweet foods simultaneously throughout the meal. In these cases, the meal was split into savoury and sweet sections of the meal but it was necessary to add all the behaviours coded under each variable relating to savoury food eating together, and likewise for sweet food eating, to arrive at overall totals for each variable for the savoury and sweet sections of the meal.

Before comparisons in eating behaviour according to whether the child was eating savoury or sweet foods can be made, it is important to establish any other differences between the two types of foods which might account for differences in eating behaviour. The first consideration is food texture. Foods come in a wide variety of textures and those prepared for very young infants are either naturally in purée form or deliberately puréed. This is to enable the child to make the first steps towards the transition from the liquid form of milk and suckling behaviour to solids eating and chewing. By the age of one year children can often cope with adult-like food textures, but as with all aspects of weaning, there are likely to be wide individual differences in the ability to cope with different food textures. The Behavioural Coding Inventory reflected differences in food textures by incorporating codes for *puréed*, *semi-solid* and *solid* foods. To begin this section of analysis, both the savoury and sweet foods were analysed for the texture of the food being served to the child. Table 7.12 shows the texture of the savoury and sweet foods served during meal 1 and meal 2. The total of textures for each meal in Table 7.12 do not always add up to 100 because some children were served more than one savoury or sweet dish during a meal and they could be of different textures.

Table 7.12 Textures of savoury and sweet foods served (g) during meal 1 and meal 2

	Purée	**Semi-solid**	**Solid**	**None given**
Savoury				
Meal 1	0	2	97	2
Meal 2	0	1	99	0
Sweet				
Meal 1	53	18	41	7
Meal 2	38	9	52	12

Table 7.12 shows that the texture of the savoury foods for both meals fell into the *solid* category with few exceptions. The texture of the sweet foods was more variable,

being fairly equally split between *purée* and *solid* with some foods falling into the *semi-solid* category.

The second consideration that might influence eating behaviour is the quantity of servings for savoury and sweet foods. Table 7.13 shows the descriptive statistics and correlation coefficients (Spearman's ρ) for the quantity of savoury and sweet foods served at meal 1 and meal 2. Table 7.13 shows that on average the children were served much more savoury than sweet foods. For the meals overall, on average approximately 65 grams more savoury foods than sweet foods were served. However, within the category of savoury food, and that of sweet food, the relationship between the amount served at the two meals was non-significant. This suggests that mothers do not serve the same amount of savoury or sweet foods at different meals.

Table 7.13 Percentiles, other descriptive statistics and correlation coefficients (Spearman's ρ) for the quantity of savoury and sweet foods served (g) at meal 1 and meal 2

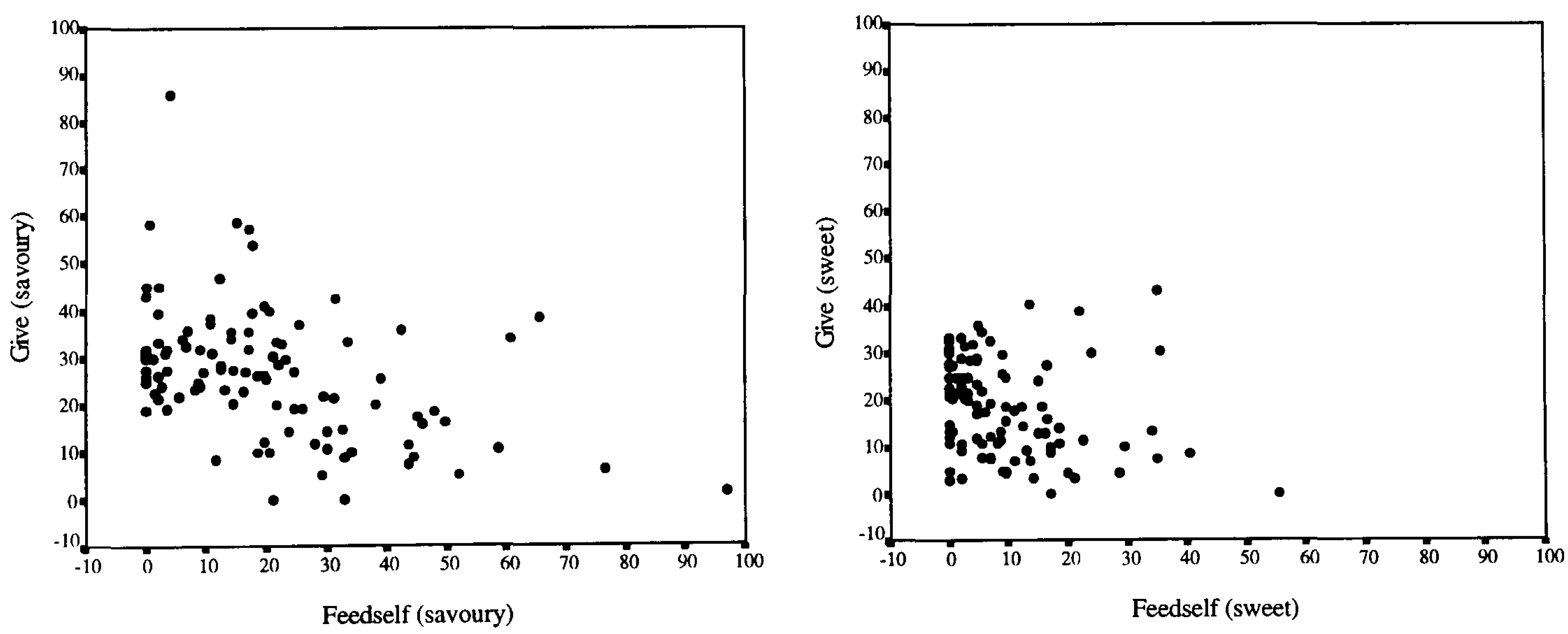
	Minimum	25th	Median	75th	Maximum	Mean	SD	Spearman's ρ
Savoury								
Meal 1	39.90	133.20	161.00	207.80	432.40	175.35	70.15	0.17
Meal 2	44.50	113.00	138.60	174.25	300.50	144.86	50.53	p=0.103
Sweet								
Meal 1	15.20	59.75	89.40	118.85	230.30	95.05	44.93	0.20
Meal 2	7.40	59.80	92.30	118.50	203.30	94.32	46.74	p=0.071

The third consideration is the timing of introducing savoury and sweet foods during the meal. During most meals mothers served the savoury foods first, followed by sweet foods. There may be differences in eating behaviour due to appetite; the child can be assumed to be hungriest at the beginning of the meal.

All three considerations, texture, quantity of food served and timing, need to be borne in mind when comparing any differences in eating behaviour according to whether the child is eating savoury or sweet foods.

Children of one year are in a transitional stage behaviourally in that they still need assistance to some extent from their mother to achieve food uptake. It was found in the previous section of results that within each meal there was a combination of the child being fed by the mother and self feeding. The next section of analyses determined whether there were differences in the relationship between *give* and *feedself* according to the type of food the child was being served. Figure 7.16 shows the relationship between *give* and *feedself* for savoury and sweet foods.

Figure 7.16 Scatterplot showing the relationship between *give* and *feedself*, for savoury and sweet foods



The correlation for *give* and *feedself* for savoury foods was statistically significant ($\rho_{(98)}=-0.44$, $p<0.0005$) and the correlation between *give* and *feedself* for sweet foods was also statistically significant ($\rho_{(98)}=-0.29$, $p=0.003$). The linear relationships are negative showing that the less the mother feeds her child, the more the child feeds itself, and vice versa. Some children are at the extremes of the scale almost exclusively being fed by their mother or feeding themselves, but most lie between these extremes.

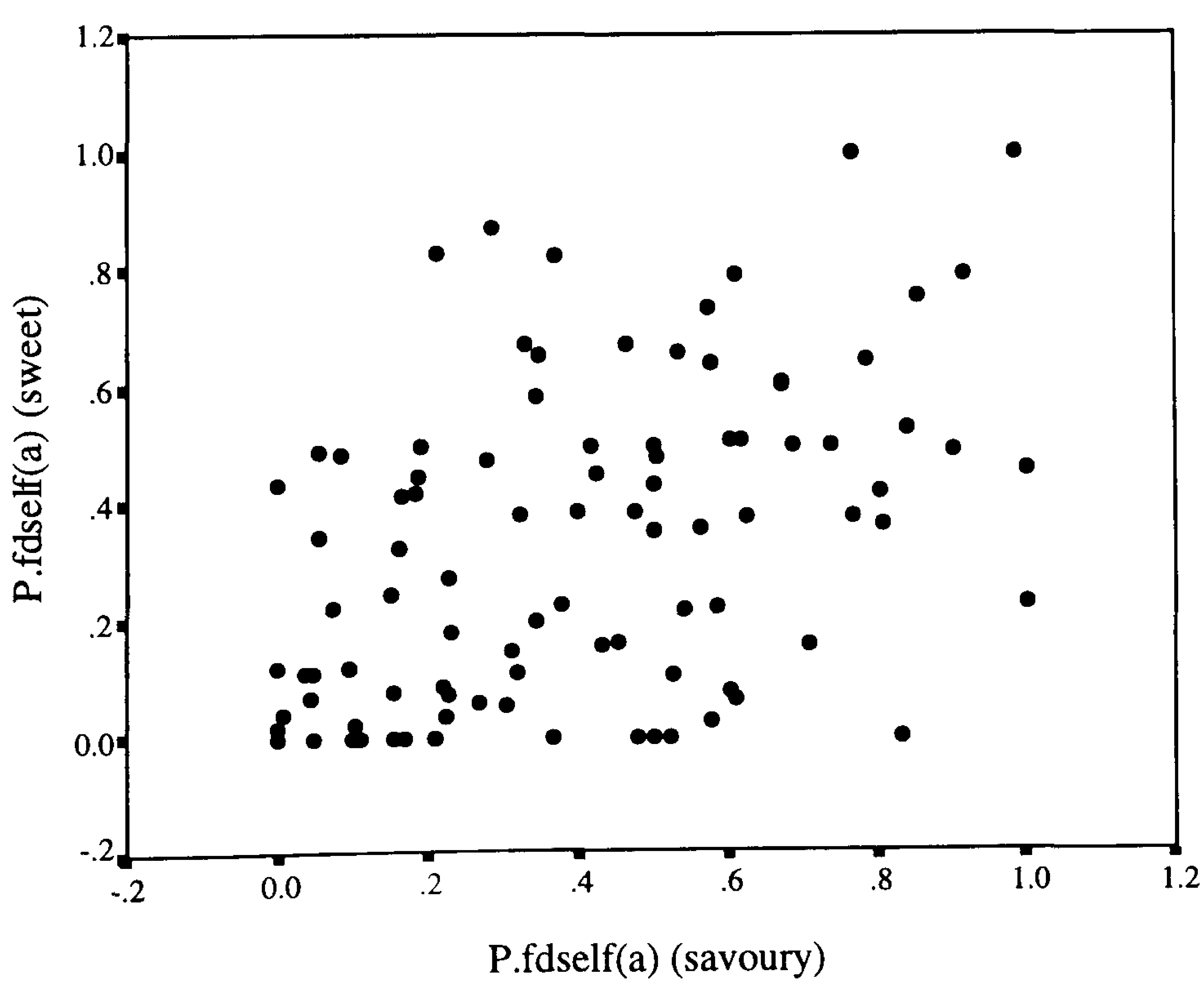
Because the scores are means for the two meals this suggests (a) that each child is entirely fed by their mother at one meal and entirely self feeding at the other or (b) that there is a combination of being fed by the mother and self feeding at both meals. This was investigated by examining the relationship between the variables *give* and *feedself* for each type of food within each meal separately. Table 7.14 shows the correlation coefficients (Spearman's ρ) between *give* and *feedself*, for savoury and sweet foods during meal 1 and meal 2. They can be compared with the overall correlation for the mean of the two meals on page 127 ($\rho_{(100)}=-0.47$) and those given for the meals separately given on page 128 ($\rho_{(100)}=-0.40$ for meal 1 and $\rho_{(100)}=-0.40$ for meal 2). Table 7.14 shows that the relationships between *give* and *feedself* within each meal for savoury and sweet foods were similar to those for the two meals combined and separately. The analyses show that the mother and child contribute behaviourally to the meal to a similar extent regardless of the type of food being served, or whether the meal is lunch or evening meal.

Table 7.14 Correlation coefficients (Spearman's ρ) between *give* and *feedself*, for savoury and sweet foods during meal 1 and meal 2

	Meal 1			Meal 2		
	ρ	*n*	*p*	ρ	*n*	*p*
Savoury						
Give						
Feedself	−0.26	98	.009	−0.43	100	.000
Sweet						
Give						
Feedself	−0.36	93	.000	−0.42	88	.000

Within-subject consistency in self feeding behaviour across types of food was examined using the variable *p.fdself(a)*, according to the type of food being served. *P.fdself(a)* is the ratio of *feedself* to *feedself* and *give*. *Feedself* and *give* together represent the total count of acts in which food can enter the child's mouth. Figure 7.17 shows the relationship between *p.fdself(a)* for savoury and sweet foods.

Figure 7.17 Scatterplot showing the relationship between *p.fdself(a)*, for savoury and sweet foods



This correlation was statistically significant ($\rho_{(98)}$=0.50, p<0.0005) showing that children who fed themselves savoury foods more also tended to feed themselves sweet foods more. It also shows that a mother who fed her child tended to do so whether the food was savoury or sweet. This shows there is some within-subject consistency in self feeding behaviour during meals across different types of foods.

The variable *p.fdself(b),* the ratio of *feedself* to *feedself* and *accept*, was also examined. This ratio expresses the proportion a child feeds itself to the number of bites taken throughout the meals. Figure 7.18 shows the distribution of scores for *p.fdself(b)* for savoury and sweet foods.

Figure 7.18 Histograms showing the distribution of scores for *p.fdself(b)*, for savoury and sweet foods.

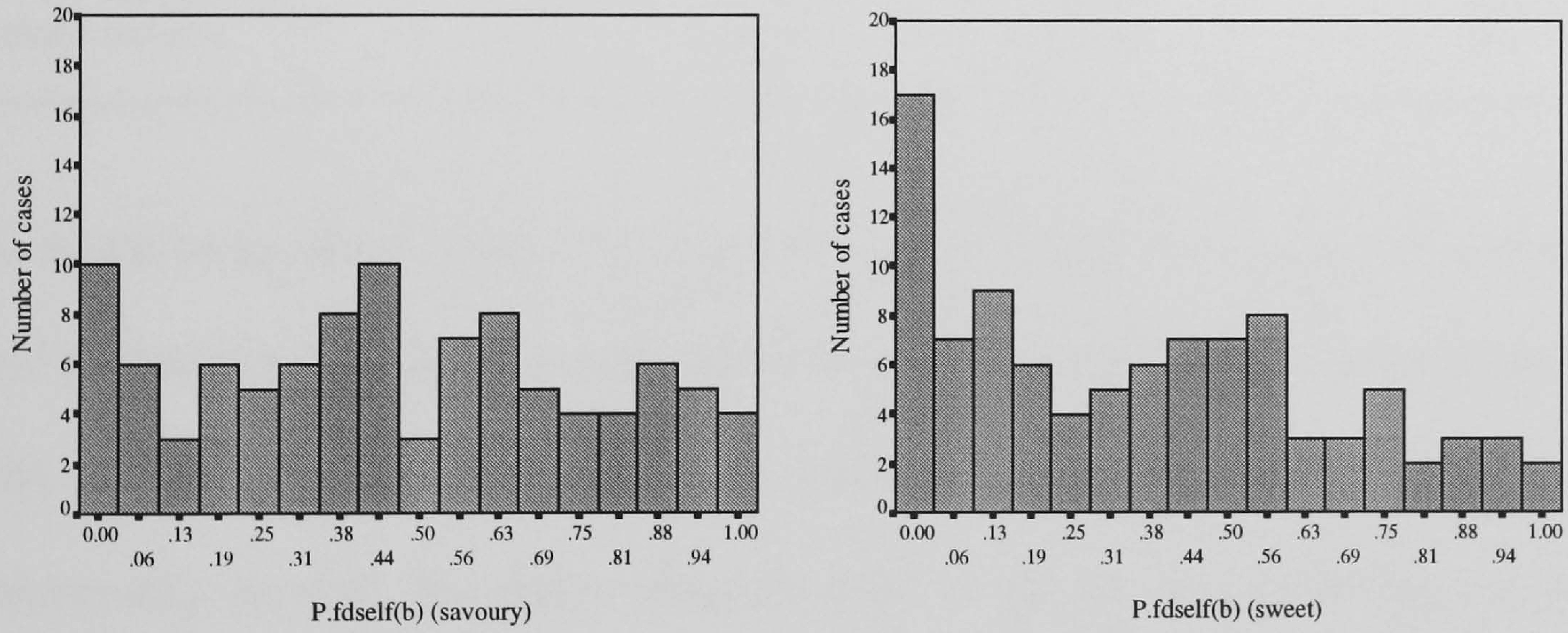


Figure 7.18 shows that there is a flat distribution of *p.fdself(b)* children across the whole scale for savoury foods, so that they are feeding themselves to varying degrees. For sweet foods, there are also children across the whole scale. However, more children are not self feeding sweet foods at all compared to savoury foods.

A mother can facilitate the child's self feeding by handing her child food and this can be analysed by examining the relationship between *hand* and *feedself*. The extent to which mothers facilitate their child's self feeding and feed their child directly can be analysed by examining the relationship between *hand* and *give*. These relationships were examined for savoury and sweet foods separately and Table 7.15 shows a summary of the correlation coefficients.

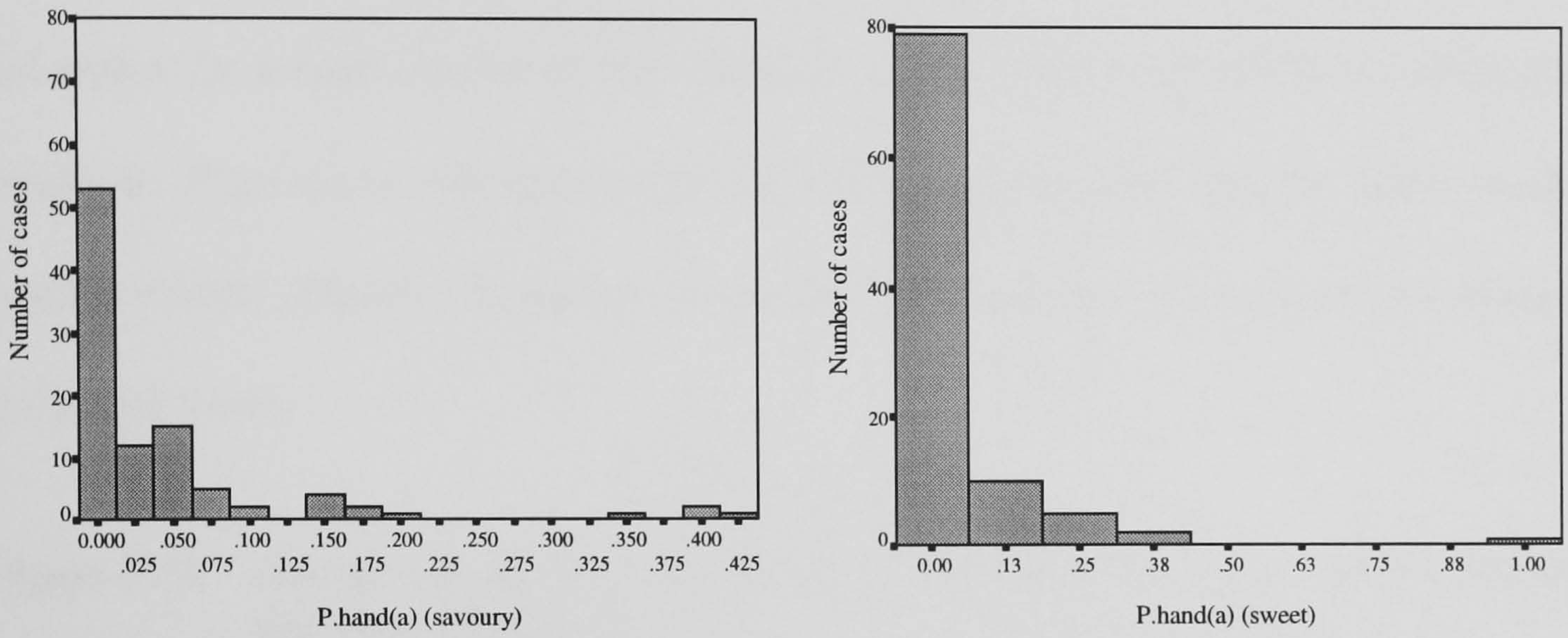
Table 7.15 Correlation coefficients (Spearman's ρ) between *hand* and *feedself*, and between *hand* and *give*, for savoury and sweet foods

	ρ	*n*	*p*
Savoury			
Hand and *feedself*	0.44	100	.000
Hand and *give*	–0.14	100	.161
Sweet			
Hand and *feedself*	0.40	98	.000
Hand and *give*	–0.23	98	.025

As might be expected, Table 7.15 shows there is a positive correlation between *hand* and *feedself* for both savoury and sweet foods. The relationship between *hand* and *give* is not statistically significant for savoury foods showing that there is no relationship between the mother handing food to the child and feeding the child directly. There is a weak negative correlation between *hand* and *give* for sweet foods showing that mothers who *give* food directly more *hand* sweet food to the child less.

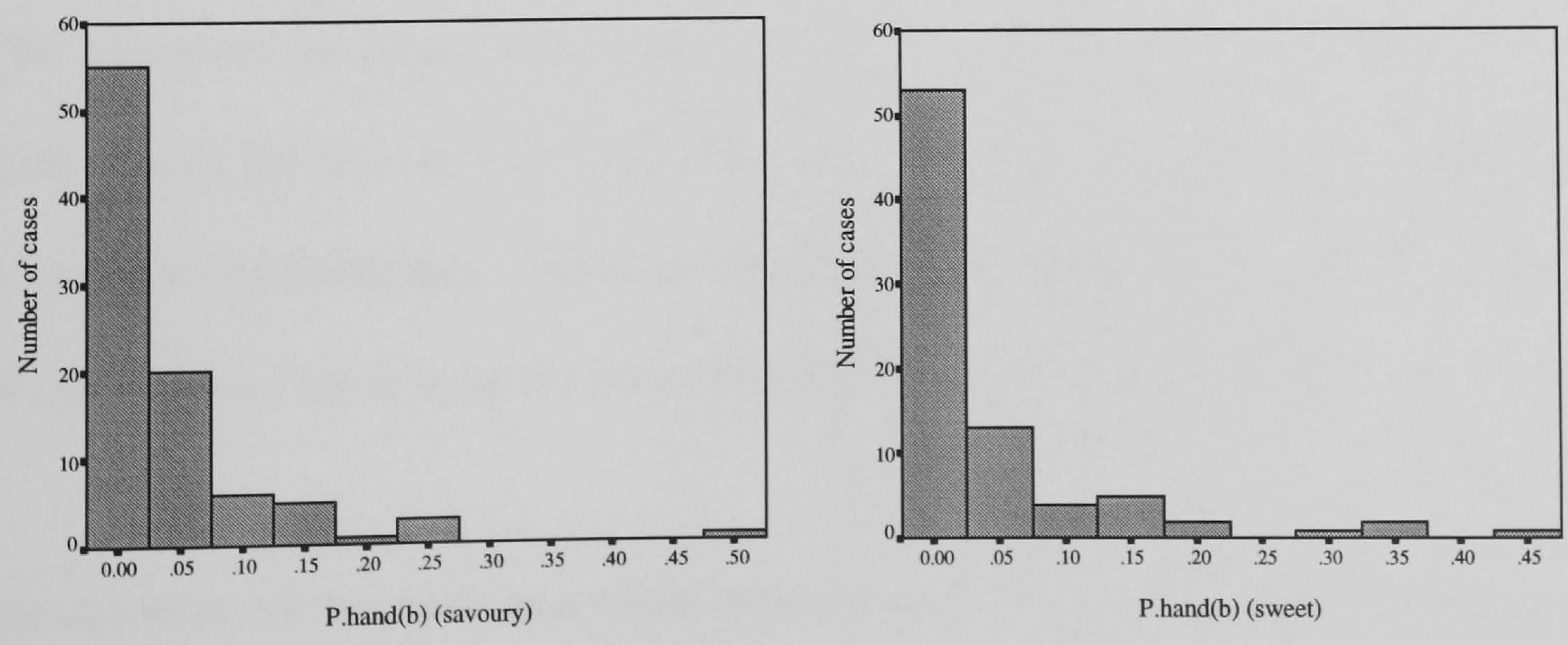
The variable *p.hand(a)* is the ratio of *hand* to *hand* and *give*. This expresses the extent to which a mother facilitates the child's self feeding rather than feeding the child directly themselves. Figure 7.19 shows the distributions of scores for *p.hand(a),* for savoury and sweet foods. The histograms in Figure 7.19 show that the majority of mothers fed their child savoury and sweet foods directly rather than facilitated self feeding.

Figure 7.19 Histogram showing the distribution of scores for *p.hand(a)*, for savoury and sweet foods



The variable *p.hand(b)* is the ratio of *hand* to *hand* and *feedself*. This expresses the extent to which a mother facilitated a child's self feeding by handing food to the child. Figure 7.20 shows the distribution of scores for *p.hand(b),* for savoury and sweet foods.

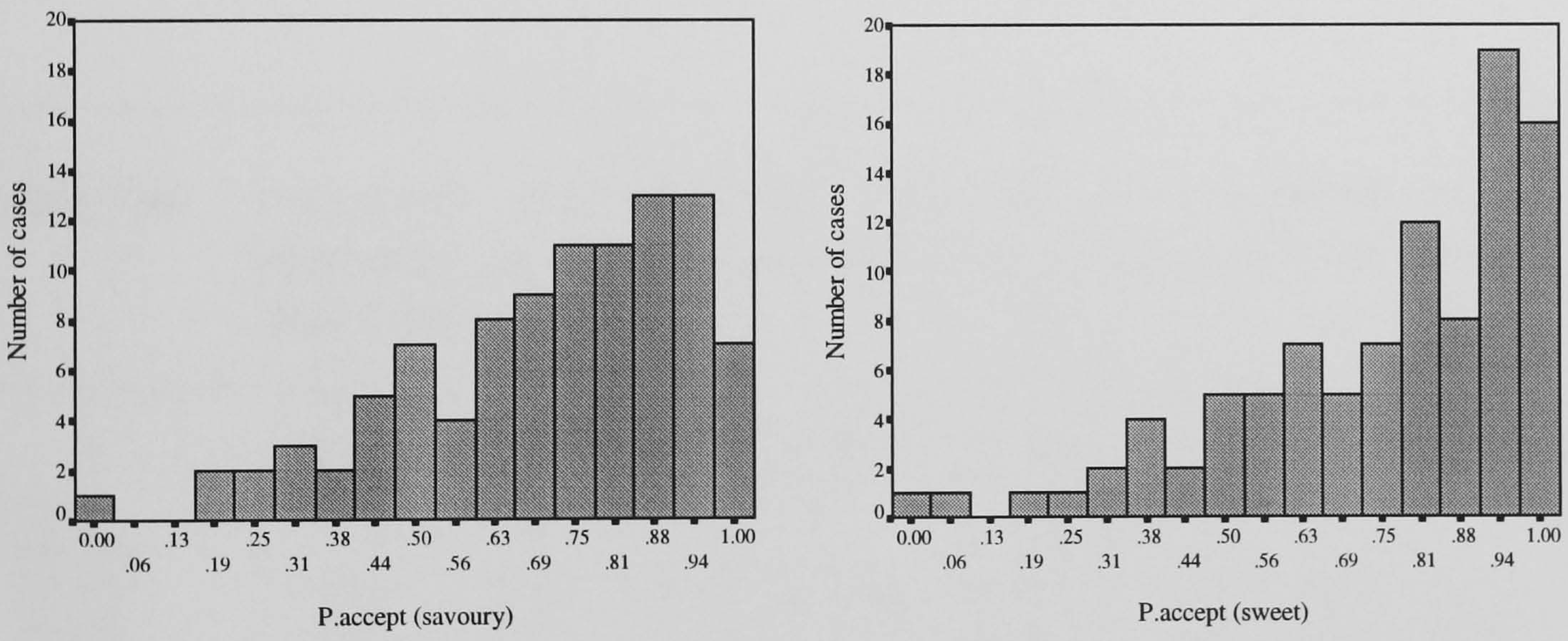
Figure 7.20 Histograms showing the distribution of scores for *p.hand(b)*, for savoury and sweet foods



The histograms in Figure 7.20 show that for savoury and sweet foods, over half of the mothers did not facilitate the child's self feeding by handing the child food.

When a child is fed directly by the mother rather than self feeding, the child's response to the food can be either to *accept* or *refuse* it. The ratio of *accept* to *accept* and *refuse* (*p.accept*) expresses the extent to which a child accepts food rather than refuses it. *P.accept* is only meaningful for children who are fed directly by the mother to some extent. Figure 7.21 shows the distribution of scores for *p.accept*, for savoury and sweet foods.

Figure 7.21 Histograms showing the distribution of scores for *p.accept*, for savoury and sweet foods



The histograms in Figure 7.21 show that the distribution of scores for *p.accept* are fairly similar for savoury and sweet foods: most children accepted food proportionally more often food than they refused it. However, more children accepted all, or nearly all, of the sweet foods from the *gives* the mother made than for savoury foods.

The durations of the meals as a whole were reported on page 116. The next section of results will extend this by examining the time one-year-olds spend eating savoury and sweet foods during meals. In this section *duration* for savoury foods refers to all the time spent eating savoury foods, and *duration* for sweet foods all the time spent eating sweet foods. In most cases this required simply deducting the time of the first feeding act with savoury food from the time of the last feeding act, to arrive at the duration for savoury foods (and similarly for sweet foods). In other cases, this procedure was complicated by the fact that the child switched from eating savoury to sweet foods more than once throughout the meal. In these cases the duration for each episode of savoury and sweet eating within the meal was calculated, and all the durations for savoury eating were summed, and similarly for sweet foods. Table 7.16 shows the descriptive statistics and correlation coefficients (Spearman's ρ) for the variable *duration* for savoury and sweet foods, for meal 1 and meal 2.

Table 7.16 Percentiles, other descriptive statistics and correlation coefficients (Spearman's ρ) for *duration* (mins), for savoury and sweet foods during meal 1 and meal 2

	Minimum	25th	Median	75th	Maximum	Mean	SD	Spearman's ρ
Savoury								
Duration								
Meal 1	0.14	7.09	10.84	14.83	31.61	11.88	6.02	0.27
Meal 2	2.48	8.25	11.76	17.44	43.36	13.16	7.54	p=.010
Sweet								
Duration								
Meal 1	1.75	4.03	5.57	8.25	21.68	6.43	3.35	0.14
Meal 2	0.59	4.57	6.27	8.05	25.57	6.99	4.11	p=.190

Table 7.16 shows that for both meals children spent much longer eating savoury foods than sweet foods - on average almost twice as long. The table shows that the correlation between *duration* for savoury foods for meal 1 and meal 2 is statistically significant, whereas for sweet foods it is non-significant. This suggests that there is

some meal-to-meal consistency in the time children spend over savoury foods but less in the time they spend over sweet foods.

However, just because a greater quantity of savoury food is served and children spent longer over it, does not in itself suggest differences in actual eating behaviour. It was seen in an earlier section of results that for the meals overall, there was an overall positive and statistically significant relationship between *duration* and *bites*. The variables *duration* and *bites* were examined for the savoury and sweet sections of the meal separately, in order to determine whether the relationship differed according to the type of food being served. The correlation between *bites* and *duration* for savoury foods ($\rho_{(100)}$=0.69, p<0.0005) and sweet foods ($\rho_{(98)}$=0.65, p<0.0005) were both statistically significant. This shows that more *bites* are associated with longer meals regardless of the type of food being eaten. Regression was used to quantify this relationship. Table 7.17 shows the coefficients from the regressions of *bites* on *duration* for savoury and sweet foods.

Table 7.17 Coefficients from the regressions of *bites* on *duration* (mins), for savoury and sweet foods

	B	SE B	*p*
Savoury			
Constant	17.10	3.10	
Duration	1.80	.23	.0000
Sweet			
Constant	6.21	1.89	
Duration	2.72	.26	.0000

Table 7.17 shows that on average, for a meal during which the child eats savoury food for, say 10 minutes, the child takes 35 bites (17.10 + 1.80*10 = 35.1) with 2 bites (1.80) for every additional minute savoury food eating continues. When the child eats sweet foods the child takes 33 bites (6.21 + 2.72*10 = 33.41) and 3 bites (2.72) for every additional minute sweet food eating continues. From these results, it can be concluded that during savoury food eating for 10 minutes duration, and during sweet food eating for 10 minutes duration, approximately the same number of bites are taken, but with each additional minute, on average a greater number of bites of sweet than savoury food are taken.

Having predicted the number of *bites* from *duration*, the next analysis was computed to enable the duration of meals to be predicted from the number of bites. Table 7.18 shows the coefficients from the regressions of *duration* on *bites*, for savoury and sweet foods.

Table 7.18 Coefficients from the regressions of *duration* (mins) on *bites*, for savoury and sweet foods

	B	**SE B**	***p***
Savoury			
Constant	3.95	1.16	
Bites	.21	.03	.0000
Sweet			
Constant	1.84	.51	
Bites	.18	.02	.0000

Table 7.18 shows that during savoury food eating for a given number of *bites*, say 20, takes on average approximately 8 minutes and an extra 13 seconds (.21 minutes) for

each extra bite. For sweet food eating the same number of *bites*, takes on average approximately 5 minutes and an extra 11 seconds (.18 minutes) for each extra bite. This shows that for a given number of *bites*, the process of eating savoury foods is slightly slower than eating sweet foods.

The variable *bites* is a variable derived by summing the counts of *accept* and *feedself*. The previous section of results (page 136) showed that *duration* was significantly related to both *accept* and *feedself* for the meals overall. This section extends this analysis by determining whether *duration* is related to *accept* and *feedself* in different ways according to the type of food being eaten. Table 7.19 shows the coefficients from the regressions of *duration* on *accept* and *feedself*, for savoury and sweet foods.

Table 7.19 Coefficients from the regressions of *duration* (mins) on *accept* and *feedself*, for savoury and sweet foods

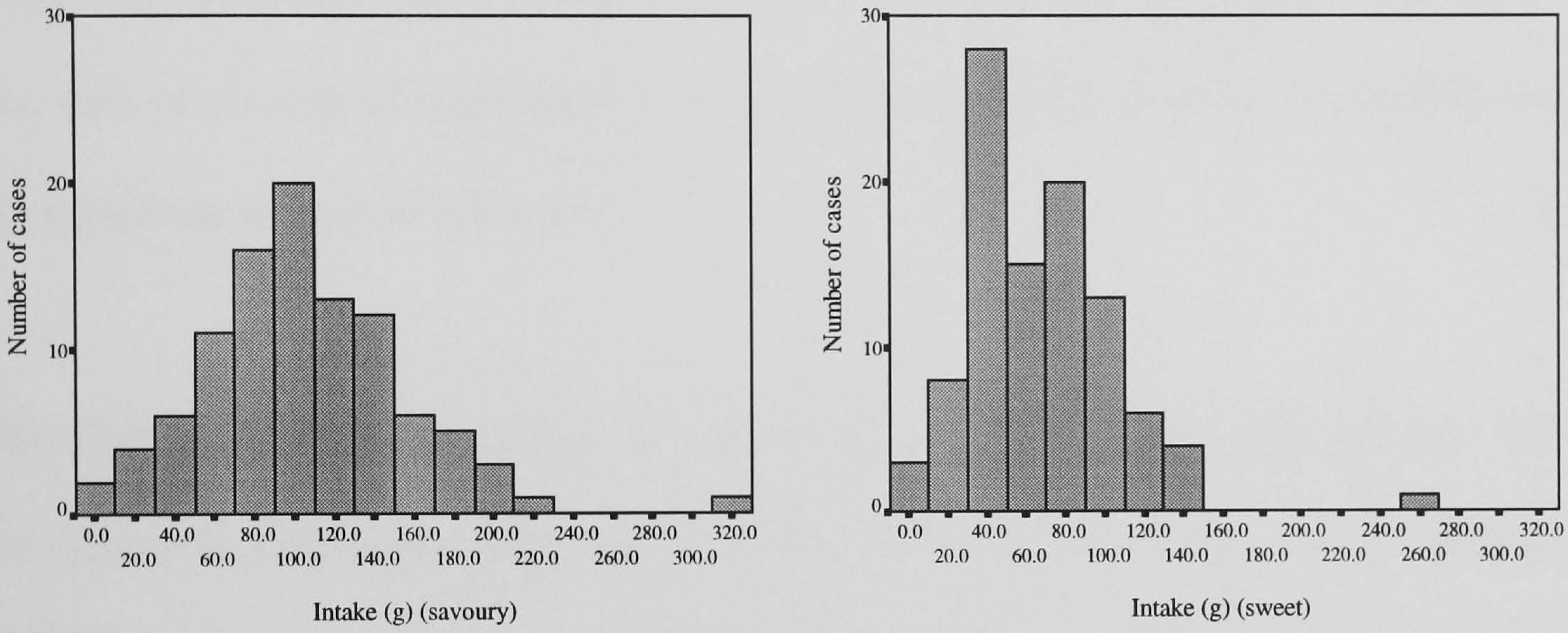
	B	SE B	*p*
Savoury			
Constant	4.93	1.33	
Accept	.16	.05	.0012
Feedself	.22	.03	.0000
Sweet			
Constant	2.07	.52	
Accept	.17	.03	.0000
Feedself	.21	.02	.0000

Table 7.19 shows that the relationship between *duration* and *accept* is statistically significant for savoury and sweet foods, and so is the relationship between *duration* and *feedself*. The results show that *duration* has a similar relationship with *feedself* and *accept* for both the savoury and sweet sections of the meal. The results for

savoury and sweet foods are also similar to those for the meal as a whole on page 136 (.13 for *accept* and .19 for *feedself*).

To begin the analysis of *intake*, the distributions were examined. Figure 7.22 shows the distribution of *intake* for savoury and sweet foods.

Figure 7.22 Histograms showing the distribution of scores for *intake* (g), for savoury and sweet foods



The distribution for savoury food intake is unimodal and roughly normal; there are children at both extremes of the scale, some eating virtually no savoury food and others eating, for example, over 200g. The distribution for sweet food intake is bimodal. It is interesting to note that one mode is at 40g and the other at 80g for sweet food intake. Many of the children were offered pre-packed desserts such as fromage frais which typically come in 40g pots (e.g. Munch Bunch Pot Shots fromage frais, 41.6g; Petits Filous Frubes fromage frais, 40g) and 80g pots (e.g. Munch Bunch Mega Pot Shots fromage frais, 80g; Nestlé Milky Bar White Chocolate Dessert, 80g) which might explain this distribution.

It might be expected that spending longer over a meal would be associated with higher food intake. This is not, however, true for the meal taken as a whole where the overall rank correlation is ≈0 (page 138). The relationship between *duration* and *intake* for savoury foods was also non-significant ($\rho_{(100)}=-0.03$, $p=0.770$) whereas that between *duration* and *intake* for sweet foods was statistically significant ($\rho_{(98)}=0.24$, $p=0.020$). This shows that spending longer eating savoury food is unrelated to savoury food intake but spending longer eating sweet foods resulted in a higher sweet food intake. The lack of an overall correlation is presumably due to the savoury component being the major component of the meal.

This finding raises the possibility that longer durations associated with savoury foods are related to behaviours not connected to increased food intake. Longer durations associated with sweet foods, on the other hand, must be related to eating behaviours which increase food intake. The next section of analyses on the savoury and sweet sections of the meal investigated relationships between children's eating behaviour and food intake according to the type of food being served. Figure 7.23 shows the relationship between the variables *intake* and *bites* for savoury and sweet foods. The correlation between *intake* and *bites* for savoury foods is statistically significant ($\rho_{(100)}=0.27$, $p=0.006$) showing that the child's food intake increases with the number of bites taken. The correlation between *intake* and *bites* is also statistically significant for sweet foods ($\rho_{(98)}=0.57$, $p<0.0005$) again showing that as the number of bites taken increases, the child's sweet food intake increases. It can be seen from comparing the scatterplots on Figure 7.23, and the correlation coefficients, that the correlation for sweet foods is much stronger (0.57) than that for savoury foods (0.27).

Figure 7.23 Scatterplot showing the relationship between *intake* (g) and *bites*, for savoury and sweet foods

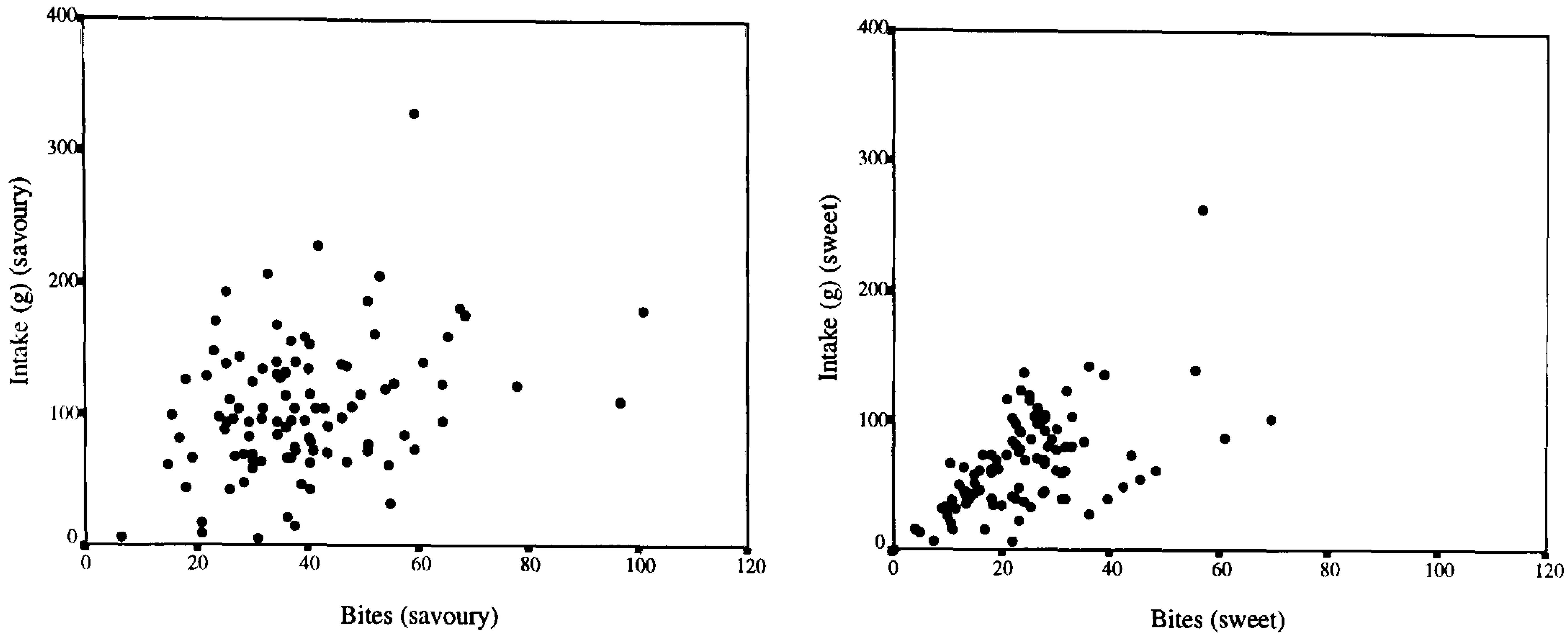


Table 7.20 shows the coefficients from the regressions of *intake* on *bites* for savoury and sweet foods.

Table 7.20 Coefficients from the regressions of *intake* (g) on *bites*, for savoury and sweet foods

	B	SE B	*p*
Savoury			
Constant	62.93	13.08	
Bites	1.08	.31	.0007
Sweet			
Constant	24.18	7.21	
Bites	1.80	.27	.0000

Table 7.20 shows that on average for, say, 30 *bites* of savoury food, 95 g are taken in (62.93 + 1.08*30 = 95.33). On average for 30 *bites* of sweet food, 78 g (24.18 + 1.80*30 = 78.18) are taken in. Because the constant is much higher for savoury than sweet foods, but the coefficients for *bites* lower, on average as the number of bites increases, the more similar the child's intake for the two types of food becomes.

It was shown earlier that there is a statistically significant relationship between *intake* and *duration* for sweet foods but not savoury foods. Table 7.21 shows the coefficients from the regression of the variables *intake, duration* and *bites* analysed together, for savoury and sweet foods.

Table 7.21 Coefficients from the regressions of *intake* (g) on *duration* (mins) and *bites*, for savoury and sweet foods

	B	SE B	*p*
Savoury			
Constant	75.54	13.34	
Duration	−3.19	1.10	.0047
Bites	1.76	.38	.0000
Sweet			
Constant	28.85	7.61	
Duration	−2.54	1.44	.0812
Bites	2.30	.39	.0000

Table 7.21 shows that for savoury foods, food intake increases with the number of *bites*. For a given number of *bites*, though, food intake decreases as longer time is spent over the meal. As was seen for the meals as a whole, longer durations eating savoury foods are associated with more *bites*, but less food taken in per *bite* (page 140). For sweet foods, food intake increases with the number of *bites* taken. In this case the relationship between *intake* and *duration* is also negative but does not reach statistical significance.

To recapitulate, analysis shows that the relationship between *duration* and *intake* was non-significant for savoury foods, and that between *bites* and *intake* was weak (ρ=0.27), whereas the relationship between *duration* and *intake* is positive and statistically significant for sweet foods and that between *bites* and *intake* was quite strong (ρ=0.57). When *duration* is taken into account, *intake* and *bites* are related to a comparable degree for savoury and sweet foods. However, when the variable *bites* is taken into account, *duration* and *intake* are related for savoury foods but not sweet foods. To emphasise the important difference here, for savoury food eating, when *bites* is taken into account a longer duration is associated with lower food intake so less food is taken in per bite; whereas for sweet food eating there is no relationship between *duration* and *intake.* Table 7.22 and Table 7.23 shows the expected (mean) value [E(Y)] of *intake* for illustrative example values of *bites* and *duration* for savoury and sweet foods respectively: the 25th, 50th and 75th centiles for the two meals combined, rounded to the nearest whole number were used. The relationships are shown graphically in Figure 7.24. The pattern of results can be seen by comparing the tables and graphs for savoury and sweet foods: the decrease in intake for sweet foods is minimal whereas for savoury foods the decrease is quite distinct and is similar to that shown for the meal as a whole on page 141.

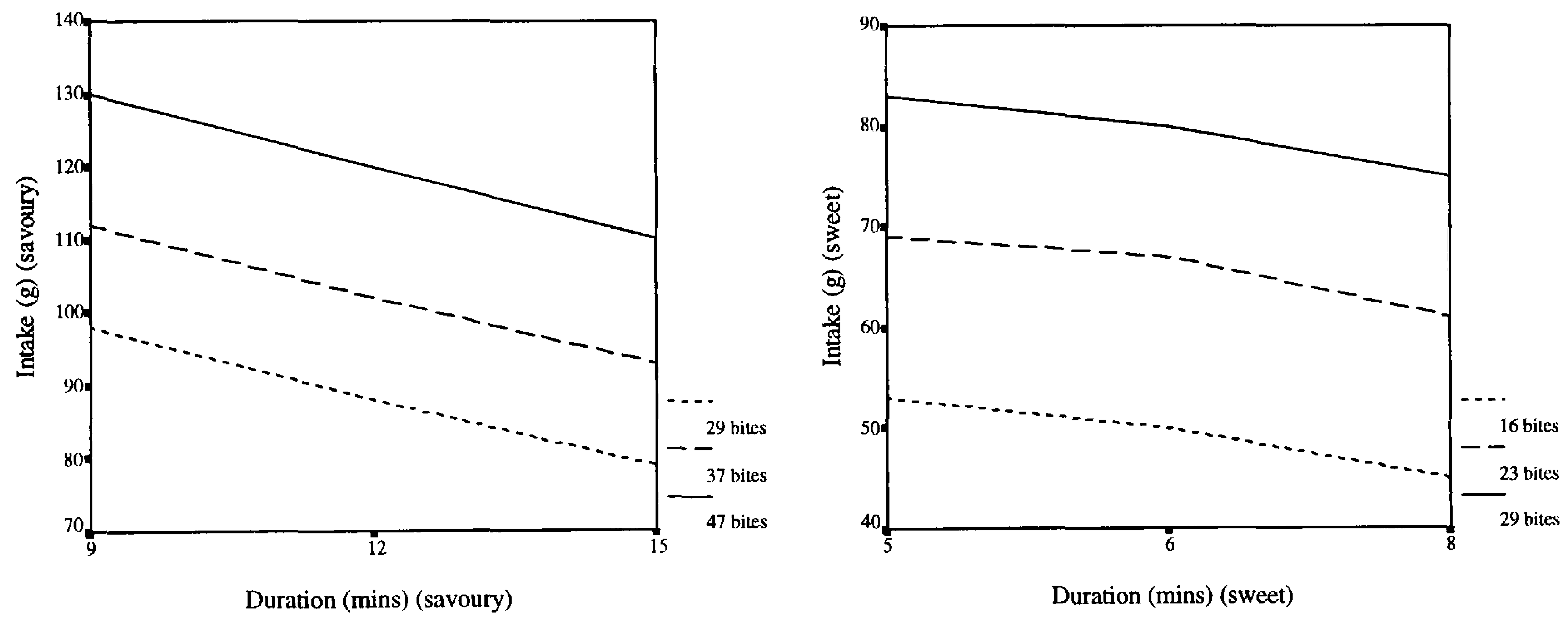
Table 7.22 Expected (mean) value [E(Y)] of *intake* (g) against 25th, 50th and 75th centile values of *bites* and *duration* (mins), for savoury foods

Bites		**Response: *intake* in grams (savoury foods)**	
29	98	88	79
37	112	102	93
47	130	120	110
Duration	**9**	**12**	**15**

Table 7.23 Expected (mean) value [E(Y)] of *intake* (g) against 25th, 50th and 75th centile values of *bites* and *duration* (mins), for sweet foods

Bites	**Response: *intake* in grams (sweet foods)**		
16	53	50	45
23	69	67	61
29	83	80	75
Duration	**5**	**6**	**8**

Figure 7.24 Graphs showing *intake* (g) for 25th, 50th and 75th centile values of *duration* (mins) and *bites*, for savoury and sweet foods



Because there was a fairly wide difference in the strength of the associations between *bites* and *intake* according to whether the food being eaten was savoury or sweet, the relationships between *intake*, *accept* and *feedself* for savoury and sweet foods were examined. Table 7.24 shows the coefficients from the regressions of *intake* on *accept* and *feedself*, for savoury and sweet foods.

Table 7.24 Coefficients from the regressions of *intake* (g) on *accept* and *feedself*, for savoury and sweet foods

	B	SE B	*p*
Savoury			
Constant	13.55	11.66	
Accept	3.89	.41	.0000
Feedself	.91	.24	.0002
Sweet			
Constant	11.63	6.44	
Accept	3.25	.32	.0000
Feedself	.94	.27	.0006

Table 7.24 shows that the relationships between *intake* and *feedself*, and between *intake* and *accept*, are both statistically significant for both savoury foods and sweet foods, showing that both the mother feeding the child and self feeding are associated with increased food intake. While eating savoury foods and accepting food from the mother for the same given number of times, say 20, on average the child takes in 91 g (13.55 + 3.89*20 = 91.35) with a further 4 g (3.89) for every extra time food is accepted. On the other hand, for self feeding savoury foods a given number of times, say 20, on average the child takes in 32 g (13.55 + 0.91*20 = 31.75) with a further 1 g (0.91) for every extra time the child feeds itself. For sweet foods the relationships show a closely similar pattern of results. The above analysis demonstrates very clearly that for both savoury and sweet food eating, the most effective way of getting food into a child is for the mother to feed it.

The next analysis examined *intake* and *duration* and their relationship with the child being fed by the mother and with the child feeding itself. Table 7.25 shows the coefficients from the regressions of *intake* on *accept*, *feedself* and *duration*, for savoury and sweet foods.

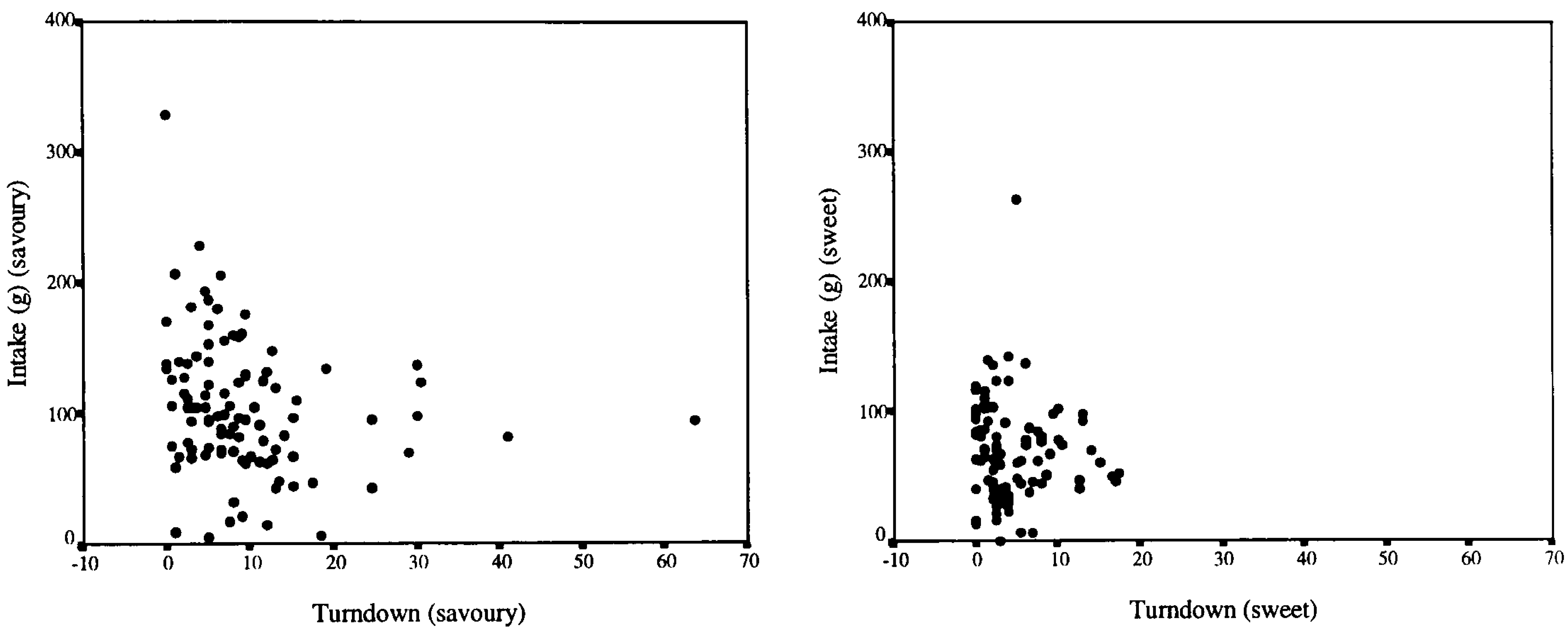
Table 7.25 Coefficients from the regressions of *intake* (g) on *accept*, *feedself* and *duration* (mins), for savoury and sweet foods

	B	SE B	*p*
Savoury			
Constant	24.31	12.12	
Accept	4.23	.42	.0000
Feedself	1.39	.30	.0000
Duration	–2.18	.86	.0130
Sweet			
Constant	14.65	6.92	
Accept	3.50	.39	.0000
Feedself	1.26	.38	.0012
Duration	–1.46	1.24	.2438

In order to interpret this analysis more easily, an example of a period of savoury food eating of 10 minutes duration and a period of 10 minutes sweet food eating will be compared. During savoury food eating and a count of, say 20 *accepts*, 87 g are taken in [24.31 + (–2.18*10) + (4.23*20) = 87.1] and for a count of 20 *feedself*, 30 g are taken in [24.31 + (–2.18*10) + (1.39*20) = 30.1]. During sweet food eating and a count of 20 *accepts*, 70 g are taken in [14.16 + (–1.46*10) + (3.50*20) = 69.6] and for a count of 20 *feedself*, 25 g are taken in [14.16 + (–1.46*10) + (1.25*20) = 24.6]. This comparison shows that for a meal of a given *duration*, *intake* is higher when the child is fed by the mother for both savoury and sweet foods.

Just as food intake is positively related to both accepting food from the mother and self feeding for savoury and sweet foods, it would be expected that the variable *intake* would be negatively related to negative behavioural responses to food. Negative responses to food can be either refusing or rejecting (spitting out) food already in the mouth. The derived variable *turndown*, the sum of the counts of *refuse* and *reject*, summarises these two responses to food. It was seen in an earlier section for the meals as a whole, that *turndown* was negatively related to *intake*. Figure 7.25 shows the relationship between *turndown* and *intake* for savoury foods and sweet foods respectively.

Figure 7.25 Scatterplots showing the relationship between *turndown* and *intake* (g), for savoury and sweet foods



The correlation between *turndown* and *intake* for savoury foods was statistically significant ($\rho_{(100)}$=–0.31, p=0.002), showing that the more times savoury food was refused or rejected, the lower the child's food intake. The correlation between the variables *turndown* and *intake* for sweet foods is non-significant ($\rho_{(98)}$=–0.10, p=0.323) showing that the child's sweet food intake is not related to the amount the child refuses or rejects food.

Figure 7.25 shows that there are far fewer high scores on *turndown* for sweet foods, which itself will reduce the correlation. Nevertheless, the fact that *turndown* and *intake* are negatively related for savoury foods but not related for sweet foods is interesting. The variable *turndown* measured whether the food is refused or rejected, and by far the bigger of these two categories is food refusal. Food refusal is a response to the variable *give*, so a possible explanation for the negative correlation between *turndown* and *intake* for savoury foods is that the mother, on observing that her child has not eaten much of the savoury food, makes an effort to feed her child the food even though the child was sometimes or always refusing or rejecting it. For sweet foods, on the other hand, the mother does not continue to *give* food when it is being refused or rejected. The relationship between *intake* and *turndown* was further analysed using regression. For this analysis, the variable *give* was entered to take the mother's behaviour into account. Table 7.26 shows the coefficients from the regressions of *intake* on *turndown* and *give*, for savoury and sweet foods.

Table 7.26 Coefficients from the regressions of *intake* (g) on *turndown* and *give*, for savoury and sweet foods

	B	**SE B**	***p***
Savoury			
Constant	62.91	8.59	
Turndown	−3.70	.53	.0000
Give	2.87	.35	.0000
Sweet			
Constant	31.03	5.82	
Turndown	−4.02	.78	.0000
Give	3.00	.32	.0000

Table 7.26 shows there is a statistically significant negative relationship between *intake* and *turndown* for savoury foods. There is also a statistically significant positive relationship between *intake* and *give*, showing that the more times the mother

gives savoury food to the child, the greater the child's food intake. Although the correlation between *intake* and *turndown* for sweet foods was non-significant (page 172), when *give* is taken into account the relationship is statistically significant. Table 7.27 and Table 7.28 shows the expected (mean) value [E(Y)] of *intake* for illustrative example values of *turndown* and *give* for savoury and sweet foods respectively: the 25th, 50th and 75th centiles for the two meals combined, rounded to the nearest whole number were used. The relationships are shown graphically in Figure 7.26.

Table 7.27 Expected (mean) value [E(Y)] of *intake* (g) against 25th, 50th and 75th centile values of *turndown* and *give*, for savoury foods

Turndown	**Response: *intake* in grams (savoury foods)**		
4	103	126	146
7	92	115	135
12	73	96	116
Give	**19**	**27**	**34**

Table 7.28 Expected (mean) value [E(Y)] of *intake* (g) against 25th, 50th and 75th centile values of *turndown* and *give*, for sweet foods

Turndown	**Response: *intake* in grams (sweet foods)**		
2	53	74	101
3	49	70	97
6	37	58	85
Give	**10**	**17**	**26**

Figure 7.26 Graphs showing *intake* (g) for 25th, 50th and 75th centile values of *turndown* and *give*, for savoury and sweet foods

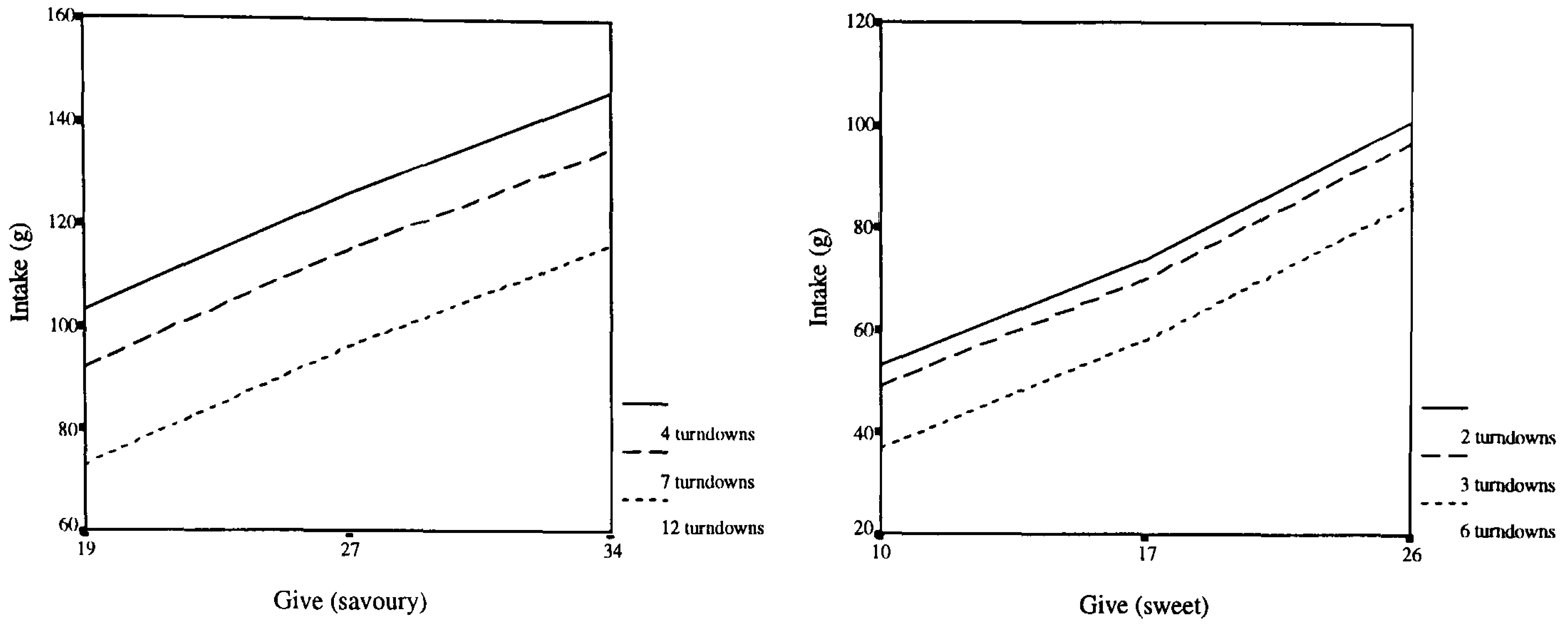
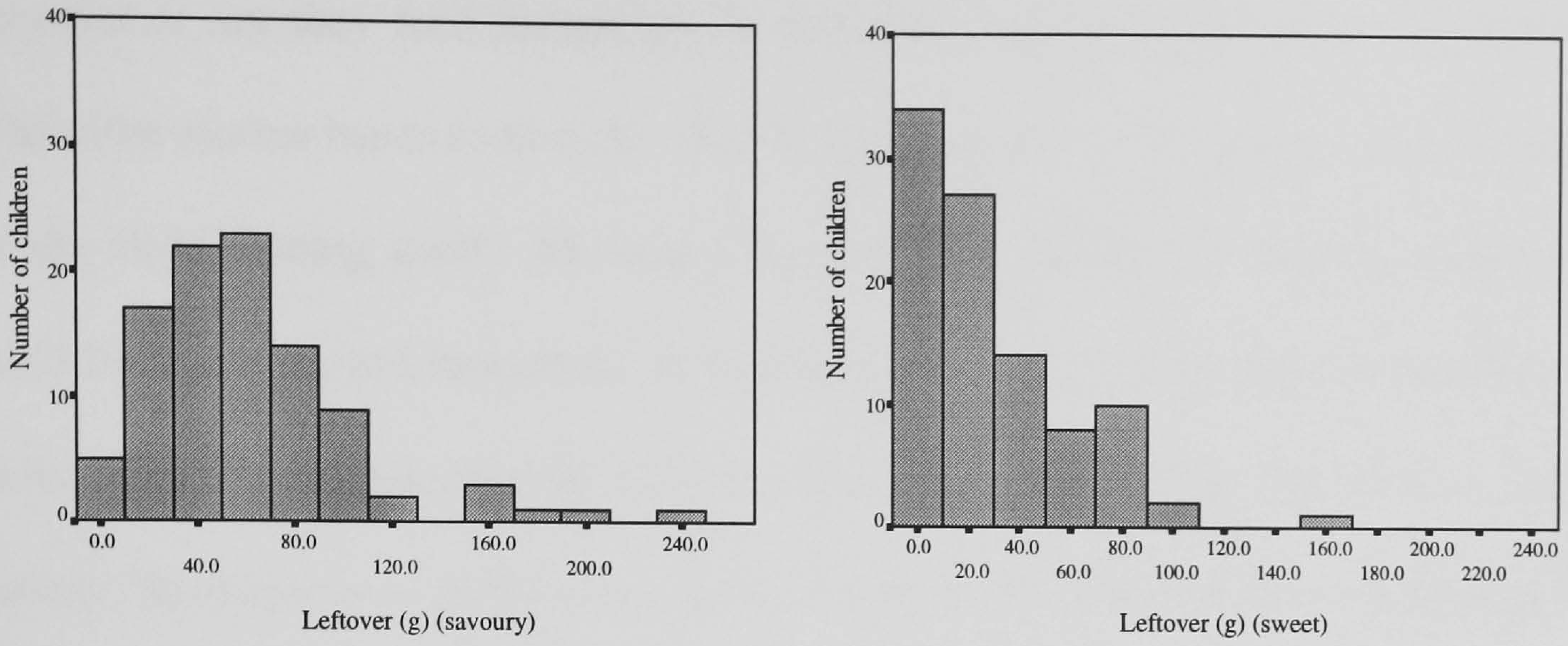


Figure 7.26 shows that there is a positive relationship between *intake* and *give* so that the more the mother *gives* food, the greater the child's food intake. However, for a given number of *gives*, *intake* decreases with the number of *turndowns*. This shows that when the mother's feeding behaviour is taken into account, refusing or rejecting food does result in lower food intake. The analyses show that the relationships between *intake*, *turndown* and *give* are similar for both savoury and sweet foods. The relationships are also similar to the results shown for the analysis of the meals as a whole (page 147).

The fact that food is turned down in both the savoury and sweet sections of the meal suggests that food of both types is left uneaten at the end of the meals. Figure 7.27 shows the amount of left over savoury and sweet food in grams averaged over the two meals.

Figure 7.27 Histogram showing the distribution of scores for *leftover* (g), for savoury and sweet foods



It can be seen from Figure 7.27 that the amount of uneaten savoury food is positively skewed; a few children leave little or no savoury food and quite a number left a fairly large quantity of food. The distribution of uneaten sweet food is completely different from that of savoury food. In this case, the distribution is not normally distributed; the majority of the children leave little or no sweet food. The difference in the patterns of scores for *leftover* is interesting, especially because the majority of children were offered sweet foods after the savoury foods. This may demonstrate sensory specific satiety; the child has had enough of one type of food and leaves it uneaten, but then goes on to eat another type of food.

Summary

While some one-year-old children feed themselves almost exclusively and others depend on their mothers for their food intake, most are at a transitional stage, attempting to feed themselves but still relying on some feeding by their mother. It has been shown that there is some meal-to-meal consistency within individuals as to whether or not they feed themselves at one year. As would be expected, in cases where the mother hands food to the child to facilitate self feeding, this action is related to the child feeding itself. Mothers who give their child food directly more often, hand food to the child less often. A high proportion of mothers did not facilitate the child's feeding by handing the child food at all. When being fed directly by the mother, the majority of children accepted food more than they refused it, although few accepted all the direct offers of food the mother made.

Children who take longer over their meal do take more bites of food. However, the longer length of the meal is not related to food intake per se; indeed, when the number of bites the child takes is taken into account, there is a negative relationship between the duration of the meal and food intake: for a given number of bites, shorter meals are associated with higher food intake. Put another way, children who take a long time to eat take in less at each bite.

Food intake from accepting food from the mother once is approximately three times higher than when the child feeds itself once, showing that the most effective way to get food into a child at this age is for the mother to feed it. As would be expected, food intake at a meal is higher if the child takes more bites over the course of the meal, and lower if the child turns down more food. There is a relationship between food intake and turning down food which remains statistically significant when the number of times the mother gives the child food directly is taken into account. In general, most children leave some food uneaten at the end of the meal. It can be concluded from this section of analysis that children are very active in the feeding process, feeding themselves and controlling their own intake when fed by the mother.

The results from analysing the meals separately according to whether the child was served savoury or sweet foods, showed some interesting differences. There was a difference in the textures of the food; savoury foods were predominately of solid texture, whereas sweet foods were a mixture of purée, semi-solid and solid textures. The sample spent nearly twice as long eating savoury as sweet foods, which might be accounted for in the quantities of the servings; on average savoury food portions were approximately 65 grams larger than portions of sweet foods.

In general, eating behaviour was not shown to be much different according to the type of food being eaten. Three main differences were found. First, the relationship between food intake and bites was much stronger for sweet than savoury eating (.27 and .57). However, for a given number of *bites*, *intake* decreased with the *duration* of the meal for savoury foods showing a similar pattern of results as the meal as a whole. For sweet foods, on the other hand, increased *intake* was related to taking more *bites* but not *duration*.

Second, food intake and turning down food are negatively related for savoury foods, but not for sweet foods. However, when the count of *gives* made by the mother is taken into account, the relationship between food intake and turning down food is statistically significant both for savoury and sweet foods. The results show a similar pattern of results as those for the meals as a whole; for a given number of *gives* food intake decreases the more the child turns down food.

Third, overall much more savoury food was left over than sweet food: most children left savoury food, but few left any or much sweet food.

The aim of this chapter was to describe feeding behaviour during the weaning stage of late infancy. In the absence of previous work it is important to make specific suggestions on the way in which meals can be analysed in future studies. Two variables important in describing meals are *duration* and *intake*. The original variables used in describing eating behaviour are *give*, *hand*, *accept*, *refuse*, *reject* and *feedself*. The derived variables are *bites*, *turndown*, *p.fdself(a)*, *p.fdself(b)*, *p.hand(a)*, *p.hand(b)* and *p.accept*. By examining these variables a great deal of information about meals can be obtained: it is possible to describe aspects of the meal, and answer important questions. The following section suggests how this might be achieved.

1. Describing the meal

The meal can be summarised using the variables *duration* and *intake*. It is important that there are specific criteria in order to determine when the meal begins and ends, so that the variable *duration* is measuring the same information across meals. It is equally important that the criteria are reported so that results from different studies can be compared.

There are two different types of information that can be obtained from measuring *intake*. The first is energy intake. However, in order to achieve accurate estimates of the child's usual energy intake over, say, 24 hours, data must be collected repeatedly for each subject. The second is quantity of intake (e.g. in grams). Again, the greater the number of times this information is collected for each subject, the more accurate the estimate of the quantity of food the child eats during a meal becomes. One distinction which can be drawn between these two measures is that the energy content of meals is entirely dependent on the mother whereas the quantity of food the child eats is dependent on the child. The decision to measure either is determined by the research questions raised.

2. How does the mother feed the child?

There are two ways in which the mother can feed her child: she can either feed the child directly; or she can place food in her child's hand to facilitate self feeding. The basic variables are *hand* and *give*. Important information about the extent to which a mother facilitates her child's self feeding rather than feeding directly can be obtained using the ratio *p.hand(a)*. *P.hand(a)* is calculated as the count of *hand* to the sum of the counts of *hand* and *give* and it expresses the extent to which a mother facilitates self feeding rather than feeds the child directly.

3. What is the child's response to the mother's feeding behaviour?

An important means of food intake control for a child in cases where its mother feeds her child directly (*give*), is achieved by the child subsequently eating the food or not. The variable *give* has two responses: *accept* and *refuse*. This aspect of feeding behaviour can be analysed using the ratio of *p.accept*. *P.accept* is calculated as the count of *accept* to the sum of the counts of *accept* and *refuse* and it provides information about how often food entered a child's mouth in response to *gives*.

Information can also be obtained about the child's negative responses to food: the child can refuse food from the mother (*refuse*), or spit out food already in its mouth (*reject*). The derived variable *turndown* summarises the number of times the child *refuses* and *rejects* food. It is important to distinguish between a mother not feeding her child, and a mother feeding her child but the child not accepting or spitting out the food. *Turndown* can be examined with the variable *give* to provide information about this aspect of eating behaviour in children.

4. How independent is the child's feeding behaviour?

One-year-olds are still learning the skills of feeding themselves and there are wide individual differences in this ability even in samples with a narrow age range. The extent of the mother's and child's input in feeding the child can be analysed by examining the variables *give*, *hand* and *feedself*. *Give* summarises a mother's attempts to feed her child directly and *hand* summarises the amount a mother hands food to her child to facilitate self feeding. *Feedself* summarises the amount a child feeds itself. The ratio *p.fdself(a)* is calculated as the count of *feedself* to the sum of the counts of *feedself* and *give*, and it expresses the extent to which a child self feeds rather than fed by the mother. The ratio *p.fdself(b)* is calculated as the count of *feedself* to the sum of the counts of *feedself* and *accept*. This ratio expresses the extent to which a child feeds itself rather than accepts food from the mother.

Information about how much of the child's self feeding is facilitated by the mother can be obtained using the ratio *p.hand(b)*. It is calculated as the ratio of the count of *hand* to the sum of the counts of *hand* and *feedself* and it expresses the extent to which a mother facilitates the child's self feeding by handing food to the child.

5. How efficient is self feeding compared to the mother feeding the child?

It is important for young children to achieve adequate nutrition, but it is also important for them to gain independence from the mother and feed themselves. When examining young children's meals a distinction must be made between the child accepting food from the mother and the child feeding itself. The variables *accept* and *feedself* summarise this information. The quantity of food intake is likely to be higher when the mother feeds her child until the child learns to self feed efficiently. This aspect of meals can be investigated by examining of *accept* and *feedself* in relation to *intake*.

Chapter Eight

Results: Mothers’ characteristics and child feeding practices

Mothers' child feeding practices and observed child eating behaviour

There is good evidence that coercive strategies, used by mothers to increase their child's food intake, are counterproductive (Birch et al., 1980; Birch et al., 1984; Birch et al., 1987). One study showed that encouraging children to focus on external factors (such as the amount of food left on a plate) compared to encouraging them to focus on internal factors (such as their level of hunger), impaired the child's ability to calorie compensate (Birch et al., 1987). There is also evidence that parents who report that they exert more control over mealtimes have children with less ability to calorie compensate (Johnson and Birch, 1994). However, neither of these studies observed the parents' child feeding practices or the children's actual eating behaviour. The second aim of the thesis was to investigate relationships between mothers' child feeding practices and the observed eating behaviour of one-year-olds.

The variables used in the analyses in Chapter Seven were *duration*, *intake*, *give*, *hand*, *accept*, *refuse*, *reject*, *feedself*, *bites*, *turndown*, *p.fdself(a)*, *p.fdself(b)*, *p.hand(a)*, *p.hand(b)* and *p.accept*. In this section of results, the following variables are examined: *duration*, *intake*, *give*, *hand*, *accept*, *refuse*, *reject* and *feedself*. The derived variable *bites* was not examined because it is comprised of *accept* and *feedself*: in the context of investigating the children's behaviour is it more informative to consider *accept* and *feedself* separately. The derived variable *turndown* summarises the variables *refuse* and *reject* (spitting food out). Again, in the context of investigating differences in eating behaviour it is more informative to examine these variables separately. The ratios *p.fdself(a)*, *p.fdself(b)*, *p.hand(a)*, *p.hand(b)* and *p.accept* are not examined in this chapter because they describe the extent to which certain actions take place in relation to other actions, and these were reported in Chapter Seven.

As well as behavioural actions during meals, the way in which the mother talks to her child may be associated with the child's eating behaviour. The mothers' verbal comments to her child are analysed in this section using the following variables. There are two variables concerning food: *food comments* (*positive* and *negative*) and three variables concerning the child's eating behaviour: *child eating behaviour* (*positive*, *negative* and *neutral*). The remaining variables are *verbal offers* which comprises verbal offers of food and verbal prompts to consume the food, *child's condition* which summarises comments about the child's hunger or satiety, and *non-food comments* which summarises comments unrelated to food or eating.

The first analysis investigated the relationship between the mothers' behavioural and verbal offers. The relationship between *give* and *verbal offers* is statistically significant ($\rho_{(100)}$=0.24, p=0.018), which indicates that mothers who feed their child directly also offer their child food and prompt its consumption verbally.

Table 8.1 shows the correlation coefficients (Spearman's ρ) between the variables measuring the mother's behavioural child feeding practices and verbal comments (*give*, *hand*, *food comments* (*positive* and *neutral*), *child eating behaviour* (*positive*, *negative* and *neutral*), *verbal offers*, *child's condition* and *non-food comments*), and variables describing the meal and the child's observed eating behaviour (*duration*, *intake*, *accept*, *refuse*, *reject* and *feedself*).

Table 8.1 Correlation coefficients (Spearman's ρ) between mothers' behaviour and verbal comments, and variables describing the meal and the child's observed eating behaviour

	Duration (mins)	***Intake*** (g)	***Accept***	***Refuse***	***Reject***	***Feedself***
Give	.08 NS	.42 $p<.0005$	.84 $p<.0005$	.43 $p<.0005$	.06 NS	−.47 $p<.0005$
Hand	.33 $p=.001$	−.12 NS	−.22 $p=.027$	.03 NS	.23 $p=.019$	.37 $p<.0005$
Food comments - positive	.32 $p=.001$	.10 NS	.09 NS	.08 NS	.11 NS	.18 NS
Food comments - neutral	.35 $p<.0005$	.08 NS	.15 NS	.05 NS	.17 NS	.15 NS
Child eating behaviour - positive	.27 $p=.004$	.17 NS	.12 NS	.04 NS	−.03 NS	.15 NS
Child eating behaviour - negative	.35 $p<.0005$	.08 NS	.15 NS	.06 NS	.10 NS	.15 NS
Child eating behaviour - neutral	.27 $p=.007$	.02 NS	.09 NS	.05 NS	.17 NS	.11 NS
Verbal offers	.44 $p<.0005$	−.07 NS	.09 NS	.30 p=.002	.13 NS	.20 $p=.050$
Child's condition	.20 $p=.048$	.23 p=.019	.17 NS	.03 NS	−.06 NS	.05 NS
Non-food comments	.50 $p<.0005$	.02 NS	.19 NS	.28 $p=.004$	.12 NS	.13 NS

Table 8.1 shows that *give* is positively related to *intake*, and negatively related to *feedself*. This shows that the mother giving more often is related to the child's intake,

and also indicates that a child who feeds itself more is fed by the mother less. The two ways in which a child can respond to *give* is to *accept* or *refuse* the food, so as one might expect, both are positively related to *give*. *Duration* and *reject* were unrelated to *give*.

Table 8.1 shows that with the exception of *give*, *duration* is statistically significantly related to all the variables (i.e. *hand* and all the verbal variables). This suggests that the longer the meal, the more the mother makes comments that fall into all the verbal categories. For this reason, except for the significant relationships with *give*, all the relationships which are statistically significant were re-analysed in regressions taking *duration* into account. The coefficients from the multiple regressions are shown in Table 8.2. The table shows that apart from one relationship, mothers' behaviour and verbal comments are unrelated to the child's observed eating behaviour when *duration* is taken into account. The exception is the relationship between *refuse* and *non-food comments* which remains statistically significant when *duration* is taken into account. This shows that the mother making comments unconnected with food and eating is associated with more food refusal from the child.

It can be concluded from these results that overall there are no relationships between the mothers' behaviour or verbal comments, and the child's eating behaviour.

Table 8.2 Coefficients from the multiple regressions of the significant relationships shown in Table 8.1 with *duration* (mins) entered into the regressions (except for the significant relationships with *give*)

	B	SE B	*p*
Accept			
Constant	33.63	4.39	
Hand	−1.15	.74	.1238
Duration	−.01	.24	.9761
Feedself			
Constant	−6.49	6.24	
Hand	−.27	1.05	.8005
Duration	1.93	.34	.0000
Reject			
Constant	.31	.83	
Hand	.17	.14	.2227
Duration	.09	.04	.0375
Feedself			
Constant	−2.44	6.92	
Verbal offers	−1.87	1.70	.2726
Duration	1.90	.30	.0000
Refuse			
Constant	−1.30	3.63	
Verbal offers	1.77	.89	.0503
Duration	.47	.16	.0038
Intake (g)			
Constant	165.32	18.10	
Child's condition	136.34	79.55	.0897
Duration	.38	.89	.6717
Refuse			
Constant	−.08	3.28	
Non-food comments	1.59	.66	.0173
Duration	.41	.16	.0119

Mothers' self-reported eating characteristics and child feeding practices

Johnson and Birch (1994) found a relationship between levels of dietary restraint in mothers and their daughters' ability to calorie compensate: the higher the level of restraint in the mother, the less the daughter demonstrated the ability to calorie compensate. The same study showed that children (boys and girls) with parents (mothers and fathers) with high levels of disinhibition demonstrated less ability to calorie compensate than children with parents with low levels of disinhibition. The third aim of the thesis was to investigate whether mothers' self-reported eating characteristics, as measured by the Three-Factor Eating Questionnaire (TFEQ), are related to their child feeding practices. Both the mothers' observed behaviour and verbal comments were analysed.

The findings from a preliminary study conducted on a sample of 150 females using the TFEQ were discussed in Chapter Two. The intercorrelations between the participant's age, BMI and scores from the subscales of the TFEQ were reported as Pearson's r because the distributions were not particularly skewed. To recapitulate briefly, statistically significant positive correlations were found between restraint and BMI, and between hunger and BMI. There were also statistically significant positive correlations between the subscales of restraint and disinhibition, and between disinhibition and hunger.

The distributions of scores for the main sample were more skewed than those for the preliminary study. For this reason both Pearson's r and Spearman's ρ were calculated. The resulting correlation coefficients were closely similar but due to the skewedness of the distributions, only Spearman's rank order coefficients are reported here. Table 8.3 shows the intercorrelations between *age*, *mother's BMI*, *restraint*, *disinhibition* and *hunger* scores for the main study.

Table 8.3 Correlation coefficients (Spearman's ρ) between *age*, *mother's BMI*, and *restraint*, *disinhibition* and *hunger* subscales

	Mother's BMI	*Restraint*	*Disinhibition*	*Hunger*
Age	0.01 NS	0.01 NS	0.08 NS	0.01 NS
Mother's BMI		0.33 p=0.001	0.44 p<0.0005	0.12 NS
Restraint			0.38 p<0.0005	0.12 NS
Disinhibition				0.48 p<0.0005

Table 8.3 shows that *age* is uncorrelated with any of the other variables. *Restraint* is positively correlated with *mother's BMI*, and *disinhibition* with *mother's BMI*. *Restraint* is correlated with *disinhibition*, and *disinhibition* with *hunger*.

The relationships between the variables reported in Table 8.3 and those for the preliminary study reported in Chapter Two, Table 2.4 are striking in their similarity. There are no relationships between *age* and the variables *BMI*, *restraint*, *disinhibition* or *hunger* for either sample. The correlation between *restraint* and *disinhibition* is 0.40 and 0.38 for the preliminary and main study respectively, and that between *disinhibition* and *hunger* is 0.55 and 0.48 respectively. BMI is associated with *restraint* to a similar degree for both samples (0.22 for the preliminary study and 0.33 for the main study). However, there is a discrepancy in the relationship between BMI and two of the subscales from the TFEQ: BMI is related to *hunger* in the preliminary study and with *disinhibition* for the main sample. Overall, comparing the results from the two studies show that selecting participants from entirely different environments (an opportunity sample at leisure centres for the preliminary study, and mothers of young children at baby clinics for the main study), yields similar correlations, at least in females of child-bearing age.

The next section of analysis investigates the mothers' child feeding practices in relation to their responses on the subscales of the TFEQ. The mothers' behavioural and verbal variables (*give* and *hand, food comments (positive* and *neutral), child feeding behaviour* (*positive, negative* and *neutral), verbal offers, child's condition* and *non-food comments*) were examined in relation to *restraint, disinhibition* and *hunger.* The variable *sex* was entered into the regressions to investigate the suggestion that restrained mothers might treat girls differently at mealtimes. Table 8.4 shows the coefficients from the multiple regressions of the mothers' behavioural and verbal variables on *restraint, disinhibition, hunger* and *sex.*

Table 8.4 Coefficients from the multiple regressions of the mothers' behavioural and verbal variables on *restraint, disinhibition, hunger* and *sex*

	B	SE B	*p*
Give			
Constant	40.27	5.25	
Restraint	.63	.46	.1722
Disinhibition	−.04	.72	.9568
Hunger	−.17	.85	.8818
Sex	−1.76	3.94	.6566
Hand			
Constant	1.45	.62	
Restraint	−.02	.05	.6910
Disinhibition	.02	.08	.7826
Hunger	−.03	.10	.7886
Sex	.03	.47	.9413

(Cont'd)

Table 8.4 (cont'd) Coefficients from the multiple regressions of the mothers' behavioural and verbal variables on *restraint, disinhibition, hunger* and *sex*

	B	SE B	*p*
Food - positive			
Constant	13.61	3.46	
Restraint	.45	.30	.1422
Disinhibition	−.55	.47	.2475
Hunger	.27	.56	.6225
Sex	−1.89	2.60	.4862
Food - neutral			
Constant	3.65	2.02	
Restraint	.19	.18	.2996
Disinhibition	.14	.28	.6050
Hunger	.07	.33	.8419
Sex	−.79	1.52	.6048
Child eating behaviour - positive			
Constant	10.49	2.95	
Restraint	.15	.26	.5757
Disinhibition	−.24	.40	.5503
Hunger	−.26	.48	.5909
Sex	.05	2.21	.9812
Child eating behaviour - negative			
Constant	.88	.38	
Restraint	.01	.03	.6581
Disinhibition	.05	.05	.3302
Hunger	−.06	.06	.3092
Sex	.16	.29	.5881
Child eating behaviour - neutral			
Constant	3.65	2.02	
Restraint	.19	.18	.2996
Disinhibition	.14	.28	.6050
Hunger	.07	.33	.8419
Sex	−.79	1.52	.6048
Verbal offers			
Constant	42.42	8.26	
Restraint	−.62	.73	.3967
Disinhibition	.57	1.13	.6163
Hunger	−.51	1.34	.7041
Sex	−.21	6.20	.9730
Child's condition			
Constant	.08	.41	
Restraint	.05	.04	.1694
Disinhibition	.19	.06	.1141
Hunger	−.02	.07	.7315
Sex	.44	.31	.1626
Non-food comments			
Constant	43.24	12.78	
Restraint	.88	1.04	.3981
Disinhibition	.52	1.61	.7476
Hunger	−.64	1.91	.7357
Sex	−7.37	8.85	.4071

Table 8.4 shows that none of the mothers' self-reported eating characteristics are related to any of the mothers' child feeding practices, either behavioural or verbal. The results suggest that *restraint*, *disinhibition* and *hunger* are unrelated to the way in which a mother feeds and talks to her child during meals. There is no support for the suggestion that restrained mothers treat girls differently at mealtimes.

The next section of this chapter investigates whether the mothers' self-reported eating characteristics are related to aspects of the meal and the child's observed eating behaviour (*duration* (mins), *intake* (g), *accept*, *refuse*, *reject* and *feedself*). Table 8.5 shows the correlation coefficients (Spearman's ρ) from the analyses.

Table 8.5 Correlation coefficients (Spearman's ρ) between mothers' *restraint*, *disinhibition* and *hunger*, and variables describing the meal and the child's observed eating behaviour

	Duration (mins)	***Intake*** (g)	***Accept***	***Refuse***	***Reject***	***Feedself***
Restraint	.00 NS	.09 NS	.15 NS	.04 NS	.14 NS	−.14 NS
Disinhibition	.03 NS	.00 NS	−.03 NS	.09 NS	−.08 NS	.04 NS
Hunger	.01 NS	.05 NS	.03 NS	.01 NS	−.15 NS	.05 NS

Table 8.5 shows that there are no statistically significant relationships between the mothers' self-reported eating characteristics and the child's observed eating behaviour.

Mother's body weight and child feeding practices

Table 8.3 shows that *restraint* and *disinhibition* are themselves related to BMI. For this reason, the BMI of the mother may be an important variable to consider in the analysis of mothers' characteristics and the way in which they feed their children. Because ratios can lead to incorrect or misleading inferences in regression analyses (Kronmal, 1993) the mothers' BMI scores not used in the analysis. Instead the variables for mothers' weight (*mother's weight*) and mothers' height^2 (*mother's height^2*) were entered into regressions separately.

The first relationship examined is that between the mother's and child's weight and as both variables are normally distributed Pearson's *r* is reported. The correlation between the two variables is very close to zero and not significant ($r_{(99)}$=0.06, p=0.528).

Table 8.6 shows the multiple regressions of mothers' behavioural child feeding practices and verbal comments (*give*, *hand*, *food comments* (*positive* and *neutral*), *child eating behaviour* (*positive*, *negative* and *neutral*), *verbal offers*, *child's condition* and *non-food comments*) on *mother's weight* and *mother's height^2*. Table 8.6 shows that the only statistically significant result is the relationship between *give* and *mother's weight*. The amount a mother feeds her child directly would be expected to be determined to some extent by the child's eating behaviour, so the variable *give* was regressed onto *mother's weight* and *mother's height^2* taking *refuse* into account. Table 8.7 shows the results of the regression.

Table 8.6 Coefficients from the multiple regressions of mothers' behaviour and verbal comments on *mother's weight* (kg) and *mother's height²* (m)

	B	SE B	*p*
Give			
Constant	31.64	21.70	
Mother's weight	.56	.16	.0010
Mother's height²	−9.16	8.43	.2799
Hand			
Constant	−.50	2.67	
Mother's weight	.01	.02	.4839
Mother's height²	.35	1.04	.7353
Food - positive			
Constant	9.25	15.21	
Mother's weight	.09	.12	.4519
Mother's height²	−.49	5.91	.9345
Food - neutral			
Constant	4.95	8.85	
Mother's weight	.01	.07	.9230
Mother's height²	.08	3.44	.9816
Child eating behaviour - positive			
Constant	1.85	12.80	
Mother's weight	.03	.10	.7272
Mother's height²	1.84	4.97	.7116
Child eating behaviour - negative			
Constant	−.80	1.66	
Mother's weight	.00	.01	.8006
Mother's height²	.63	.65	.3337
Child eating behaviour - neutral			
Constant	4.95	8.85	
Mother's weight	.01	.07	.9230
Mother's height²	.08	3.44	.9816
Verbal offers			
Constant	20.31	35.73	
Mother's weight	.08	.27	.7951
Mother's height²	5.49	13.88	.6931
Child's condition			
Constant	−1.72	1.77	
Mother's weight	.02	.01	.1504
Mother's height²	.50	.69	.4729
Non-food comments			
Constant	−10.87	50.99	
Mother's weight	.36	.39	.3595
Mother's height²	12.68	19.81	.5237

Table 8.7 Regression of *give* on *mother's weight* (kg), *mother's height*^{2} (m) and *refuse*

	B	SE B	t	p
Constant	25.75	35.16		
Mother's weight	.37	.14	2.70	.0082
Mother's height^2	−10.21	22.61	−.45	.6526
Refuse	.95	.13	7.27	.0000

Analysis of Variance

	DF	Sum of squares	Mean square	F	p
Regression	3	14848.09	4949.36	23.47	.0000
Residual	95	20035.82	210.90		
Total	98	34883.91			

Multiple R	.65
R square	.43
Adjusted R square	.41
Standard error	14.52

Table 8.7 shows that the relationship between *give* and *mother's weight* is statistically significant when the number of times the child *refuses* food is taken into account. This result shows then, that heavier mothers *give* food at a higher rate than lighter mothers even when the child's response is accounted for. The relationship between *give* and *mother's weight* is shown in Figure 8.1.

Figure 8.1 Scatterplot showing the relationship between *give* and *mother's weight* (kg)

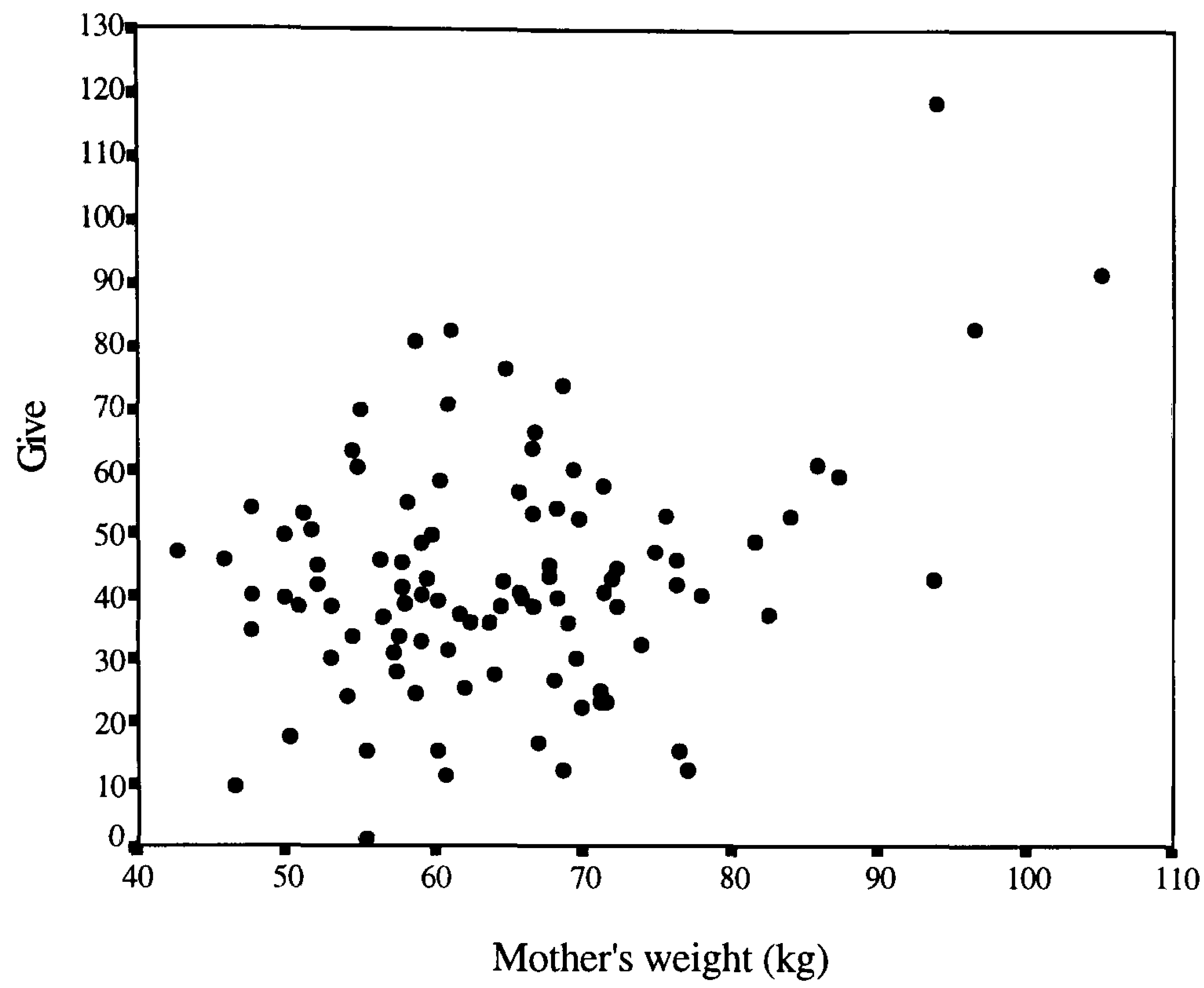


Figure 8.1 shows that there are three mothers who *give* at a high rate and whose body weight is well above the weight of the rest of the sample. In order to determine the extent of their overweight, the BMI for the sample was examined. There are eight obese mothers according to the modified WHO classification of Overweight and Obesity: five mothers of Grade IIa overweight (BMI 30.00-34.99) and three of Grade IIb overweight (BMI > 35.00) (Bray et al., 1998). It is interesting to note that of these, the three most severely obese (BMI > 35) each *gave* food well above the average number of times and more times than any other mother in the sample. (These are the three cases in the top right hand corner of Figure 8.1). This is potentially a very important finding and raises the possibility that obese mothers feed their children in a different way to non-obese mothers. For example, they may be less sensitive to their child's cues that they have had enough to eat, or have an unrealistic expectation of how much a child of one year needs to eat to achieve adequate nutrition.

Summary

As expected, there is a relationship between *give* and *verbal offers*. The results of this section show that mothers' behaviour and verbal comments are unrelated to children's eating behaviour. The only exception is that *non-food comments* are related to *refuse* when *duration* is taken into account.

The intercorrelations between BMI and the subscales of the TFEQ were similar to those found for the preliminary study, with the exception that BMI is related to *hunger* for the preliminary study and to *disinhibition* for the main study. Mothers' self-reported eating characteristics are unrelated to their child feeding practices, and there was no evidence to support the suggestion that restrained mothers treat girls differently at mealtimes. In addition, there are no relationships between the mothers' self-reported eating characteristics and the child's observed eating behaviour.

When the mothers' BMI was examined (with weight and height^2 entered separately into regressions) in relation to behavioural child feeding practices and verbal comments there was only one statistically significant relationship; a positive correlation between *mothers' weight* and *give* (feeding the child directly) and this remains the case when the child's response is taken into account using regression. It was striking that the mothers with the very highest BMIs fed their children directly at a far higher rate than any of the other mothers. This suggests that obese mothers may differ from non-obese mothers in their child feeding practices.

Chapter Nine

Results: Sex, child body weight and eating behaviour

Sex and eating behaviour

There is some evidence that girls and boys differ in their ability to calorie compensate (Johnson and Birch, 1994), which has led to the suggestion that there may be differences in the way they are treated during meals. The fourth purpose of the study was to investigate whether there are any sex differences in eating behaviour at one year, and whether boys and girls are treated differently at mealtimes. This section of Chapter Nine reports the analyses examining these issues.

The variables used in the analyses discussed in Chapter Seven were *duration*, *intake*, *give, hand, accept, refuse, reject, feedself, bites, turndown, p.fdself(a), p.fdself(b), p.hand(a), p.hand(b) and p.accept.* Because the purpose of this section is to look at differences in the behaviour of boys and girls, the original variables *accept*, *feedself*, *refuse* and *reject* were analysed separately rather than the derived variables *bites* and *turndown*. Table 9.1 shows the comparison between boys and girls on the variables listed above, except *bites* and *turndown*, using the Mann-Whitney (*U*) test. The table shows that there are no statistically significant differences between boys and girls on the variables *duration*, *give*, *hand*, *accept*, *refuse*, *reject*, *feedself*, *p.fdself(a)*, *p.fdself(b)*, *p.hand(a)* or *p.hand(b)*. There is a statistically significant difference in *intake*, with boys having a higher food intake than girls. The only other statistical difference between boys and girls is for the variable *p.accept*, the ratio of *accept* to *accept* and *refuse*.

Table 9.1 Comparison of variables (*duration* (mins), *intake* (g), *give, hand, accept, refuse, reject, feedself, p.fdself(a), p.fdself(b), p.hand(a), p.hand(b) and p.accept*) between boys and girls

Variables	Mean rank Boys (51)	Mean rank Girls (49)	U	Two-tailed p
Duration	52.53	48.39	1146.0	.4754
Intake	56.35	44.41	951.0	.0396
Give	51.93	49.01	1176.5	.6147
Hand	48.53	52.55	1149.0	.4689
Accept	53.10	47.80	1117.0	.3608
Refuse	45.23	55.99	980.5	.0635
Reject	49.56	51.48	1201.5	.7385
Feedself	48.08	53.02	1126.0	.3944
P.fdself(a)	48.37	52.71	1141.0	.4543
P.fdself(b)	47.80	53.31	1112.0	.3430
P.hand(a)	48.57	52.51	1151.0	.4790
P.hand(b)	47.07	47.93	1084.5	.8760
P.accept	54.55	43.33	904.0	.0497

It is interesting that *p.accept* is significant when there is no statistically significant difference in the variables *accept* or *refuse* when analysed separately. However, Table 9.1 shows there is a weak trend towards boys refusing food fewer times than girls which might partly explain their higher intake. In order to investigate *p.accept* further, the regression of *intake* on *accept*, *refuse* and *sex* was examined and the results are shown in Table 9.2. Table 9.2 shows that *accept* and *refuse* are related to *intake*. When *accept* and *refuse* are held constant, boys' *intake* is still significantly higher than that of girls. The variables *accept* and *refuse*, then, do not account for boys' higher food intake.

Table 9.2 Regression of *intake* (g) on *accept, refuse* and *sex* (0=male, 1=female)

		B	SE B	*t*	*p*
Constant		102.78	12.79		
Accept		2.62	.31	8.05	.0000
Refuse		−1.10	40	−2.79	.0064
Sex		−19.74	9.03	−2.19	.0313
Analysis of Variance	DF	Sum of squares	Mean square	*F*	*p*
Regression	3	180260.61	60086.87	29.90	.0000
Residual	96	192907.00			
Total	99	373167.61			
Multiple R		.70			
R square		.48			
Adjusted R square		.47			
Standard error		44.83			

The ways in which a child can achieve food intake is by accepting food and self feeding, and subsequently not rejecting the food. There is no evidence that *intake* is higher for boys due to differences in eating behaviour: Table 9.1 shows that boys do not *accept* food or *feedself* more times than girls, or *reject* food less. Having ruled out the possibility of differences in eating behaviours, there is one other explanation, although it is speculative. This is the possibility that boys have larger mouthfuls (either from *accept* or *feedself*) than girls.

Boys on average are heavier and taller than girls. To examine the possibility that the differences found in *intake* between boys and girls can be accounted for by differences in weight or height (rather than *sex* per se), *intake* was regressed onto *child's weight*$_{12}$, *child's length*$_{12}$ and *sex*. The results are shown in Table 9.3.

Table 9.3 Regression of *intake* (g) on *child's weight*$_{12}$ (kg), *child's length*$_{12}$ (m) and *sex* (0=male, 1=female)

		B	SE B	*t*	*p*
Constant		145.71	214.80		
Weight$_{12}$		7.75	7.54	1.03	.3068
Length$_{12}$		−60.09	335.76	−.19	.8537
Sex		−26.00	13.210	−1.97	.0520
Analysis of Variance	DF	Sum of squares	Mean square	*F*	*p*
Regression	3	29786.53	9928.77	2.80	.0443
Residual	95	337150.08	3548.95		
Total	98	366936.61			
Multiple R		.29			
R square		.08			
Adjusted R square		.05			
Standard error		59.57			

Table 9.3 shows that when the child's weight and height are held constant, the relationship between *intake* and *sex* remains, although it just misses statistical significance. This result suggests that higher food intake in boys cannot be fully accounted for by the fact that on average boys are heavier and taller than girls.

The next section of analyses investigates whether mothers talk to their child differently according to the sex of the child. Table 9.4 shows the comparison of variables measuring the mothers' verbal comments from the Verbal Coding Inventory (*food* (*positive* and *neutral*), *child eating behaviour* (*positive*, *negative* and *neutral*), *verbal offers*, *child's condition*, and *non-food comments*) according to whether their child is a girl or a boy using the Mann-Whitney (*U*) test.

Table 9.4 Comparison of variables measuring the mothers' verbal comments according to the child's sex

Variables	Mean rank Boys (51)	Mean rank Girls (49)	*U*	Two-tailed *p*
Food - positive	53.78	47.08	1082.0	.2479
Food - neutral	52.61	48.31	1142.0	.4577
Child eating behaviour - positive	49.74	51.30	1210.5	.7876
Child eating behaviour - negative	48.13	52.97	1128.5	.3883
Child eating behaviour - neutral	52.61	48.31	1142.0	.4577
Verbal offers	48.56	52.52	1150.5	.4948
Child's condition	47.19	53.95	1080.5	.2123
Non-food comments	50.96	50.02	1226.0	.8713

Table 9.4 shows that there are no statistically significant differences in the mothers' verbal comments to her child according to the child's sex.

Child body weight and eating behaviour

Previous studies have shown relationships between child body weight and eating behaviour. Two of the most consistent findings are that overweight children have shorter meals, and a faster bite rate, than normal weight children (e.g. Keane et al., 1981; Nakao et al., 1990). However, these relationships have only been shown in studies using composition controlled meals. The fifth purpose of the study was to relate children's eating behaviour to body weight, observed under natural conditions, both at the time of observation and prospectively six months later to investigate whether eating characteristics predict weight gain.

In order to calculate individual relative body fat, weight is adjusted for height. In newborn children the ponderal scale (weight/length^3) is used. Due to developmental changes, by adulthood the body mass index or BMI (weight/height^2) is a more accurate adjustment for height. If adjustment for height is good, either index should be highly correlated with weight but have no correlation with height. In order to calculate which adjustment would be most appropriate for this sample of children, the logarithm of the mean weight was regressed onto the logarithm of the mean height of the sample. The resulting coefficient from this analysis was 2.49 at 12 months, and 2.44 at 18 months. Because the coefficients are nearer to two than three, weight/length^2 (i.e. BMI) was used in the analyses. The use of ratios in regression analyses can lead to misleading interpretation of results (Kronmal, 1993), so weight and length^2 were entered separately into regressions. The variables are referred to as *child's* $weight_{12}$ and *child's* $length^2_{12}$ when the child was 12 months, and *child's* $weight_{18}$ and *child's* $length^2_{18}$ when the child was 18 months.

Relationships between the child's eating behaviour and the child's BMI were investigated. Table 9.5 shows the coefficients from the multiple regressions of variables (*duration, intake, accept, refuse, reject* and *feedself*) on *child's* $weight_{12}$ and *child's* $length^2_{12}$). Because there is evidence from previous studies (e.g. Keane et al., 1981; Nakao et al., 1990) that overweight children have a faster bite rate, this is also investigated by examining the regression of *bites* on *duration*, *child's weight*$_{12}$ and *child's length*$^2_{12}$ and the results are also shown in Table 9.5.

Table 9.5 Coefficients from the multiple regressions of variables (*duration* (mins), *intake* (g), *accept*, *refuse*, *reject* and *feedself*) on *child's weight*$_{12}$ (kg) and *child's length*$^2_{12}$ (m)

	B	SE B	*p*
Duration			
Constant	19.97	9.90	
Child's weight$_{12}$	−1.50	.86	.0843
Child's length$^2_{12}$	23.85	24.18	.3265
Intake			
Constant	37.29	87.73	
Child's weight$_{12}$	9.17	7.60	.2309
Child's length$^2_{12}$	56.47	214.37	.7928
Accept			
Constant	.99	21.41	
Child's weight$_{12}$	−.16	1.86	.9314
Child's length$^2_{12}$	54.81	52.32	.2974
Refuse			
Constant	28.71	15.92	
Child's weight$_{12}$	−3.81	1.38	.0068
Child's length$^2_{12}$	35.81	38.89	.3595
Reject			
Constant	−5.08	4.12	
Child's weight$_{12}$	−.56	.36	.1230
Child's length$^2_{12}$	21.99	10.07	.0614
Feedself			
Constant	39.03	35.67	
Child's weight$_{12}$	−3.07	3.09	.3233
Child's length$^2_{12}$	36.70	87.16	.6746
Bites			
Constant	5.04	25.81	
Duration	1.75	.26	.0000
Child's weight$_{12}$	−.61	2.22	.7847
Child's length$^2_{12}$	49.74	62.07	.4249

Table 9.5 shows that there are no relationships between six of the outcome variables (*duration*, *intake*, *accept*, *reject*, *feedself* and *bites*), and *child's weight*$_{12}$ or *child's length*$^2_{12}$. The variable *refuse* was related to *child's weight*$_{12}$. The relationship between *refuse* and *child's weight* is shown in Figure 9.1.

Figure 9.1 Scatterplot showing the relationship between *refuse* and *child's weight*$_{12}$ (kg)

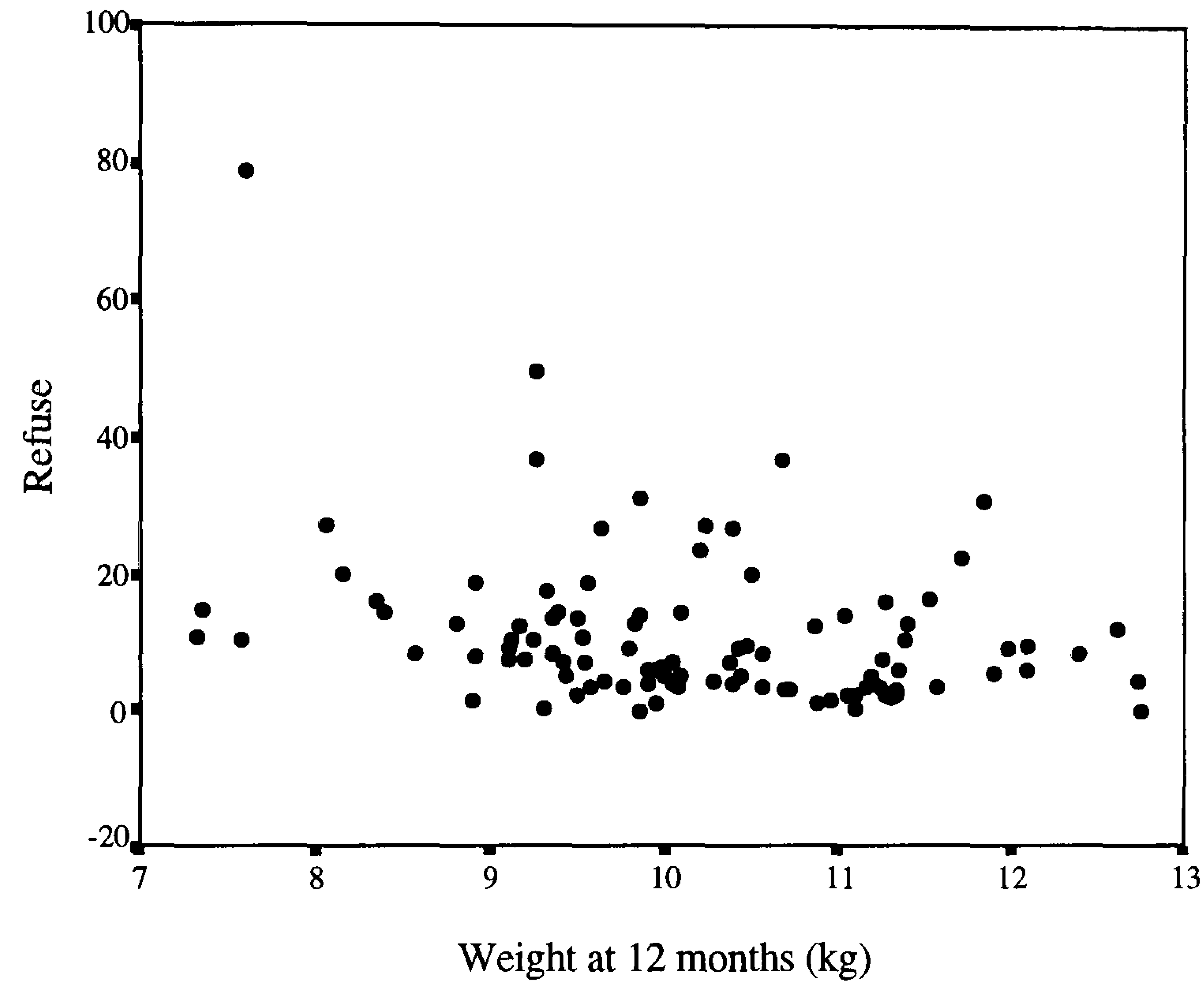


Figure 9.1 shows that some of the children do not *refuse* food at all, and many do so only a very few times. Some children, on the other hand, *refuse* food on many occasions before the meal is discontinued. The correlation between *refuse* and *child's weight*$_{12}$ is statistically significant ($\rho_{(100)}$=–0.31, p<0.002), with the rate of refusing food going down as body weight rises. It is possible that mothers with children with higher body weights *give* food more often than children with lower body weights which would account for this finding. The regression of *refuse* on *child's weight*$_{12}$ and *give* was examined to investigate this possibility and the results are shown in Table 9.6.

Table 9.6 Regression of *refuse* on *child's weight*$_{12}$ (kg) and *give*

		B	SE B	t	p
Constant		19.18	8.01		
Child's weight$_{12}$		−2.31	0.74	3.14	.0022
Give		.36	.05	7.66	.0000
Analysis of Variance	DF	Sum of squares	Mean square	F	p
Regression	2	5598.28	2799.14		
Residual	97	7280.25	75.05	37.29	.0000
Total	99	12878.53			
Multiple R		.66			
R square		.43			
Adjusted R square		.42			
Standard error		8.66			

Table 9.6 shows that the relationship between *refuse* and *give*, and that between *refuse* and *child's weight*$_{12}$ is statistically significant. The results show that for the group of children as a whole, the more times the mother *gives* food, the more times it is *refused.* However, children with higher body weights *refuse* food significantly less often than those with lower body weights, even when the mothers' behaviour is taken into account.

Figure 9.1 shows that there was one child whose eating behaviour is unlike any other during the meals (point 7.60, 79): the child *refuses* food more times than any of the others in the sample. Furthermore, this child, a boy, had the lowest body weight of the whole sample of boys. To test how influential this point was on the regression coefficient, an influence statistic, DfBeta was used. DfBeta describes the change in the regression coefficient that results from having excluded one particular case. Figure 9.2 illustrates the influence of the extreme point on the regression of *refuse* on *child's weight$_{12}$* and *give*.

Figure 9.2 Scatterplots showing the influence of individual cases from the regression of *refuse* on *child's weight$_{12}$* (kg) and *give*

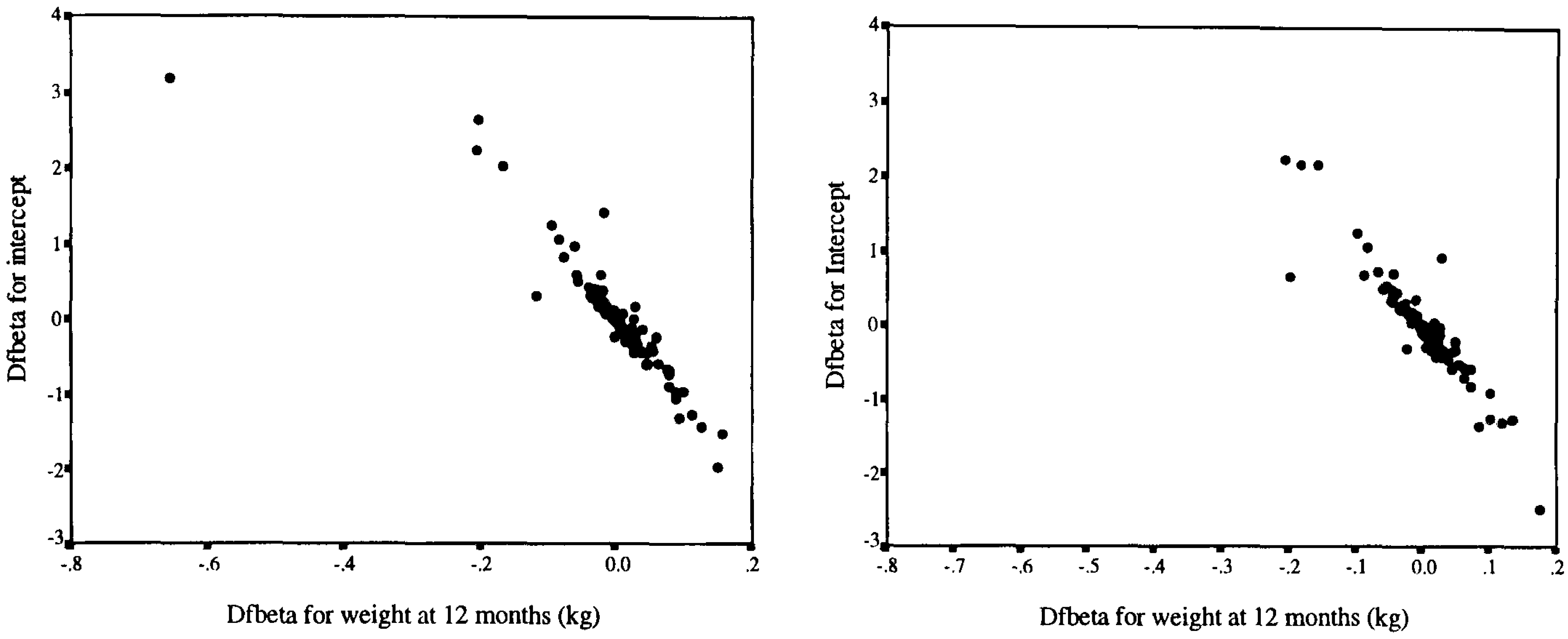
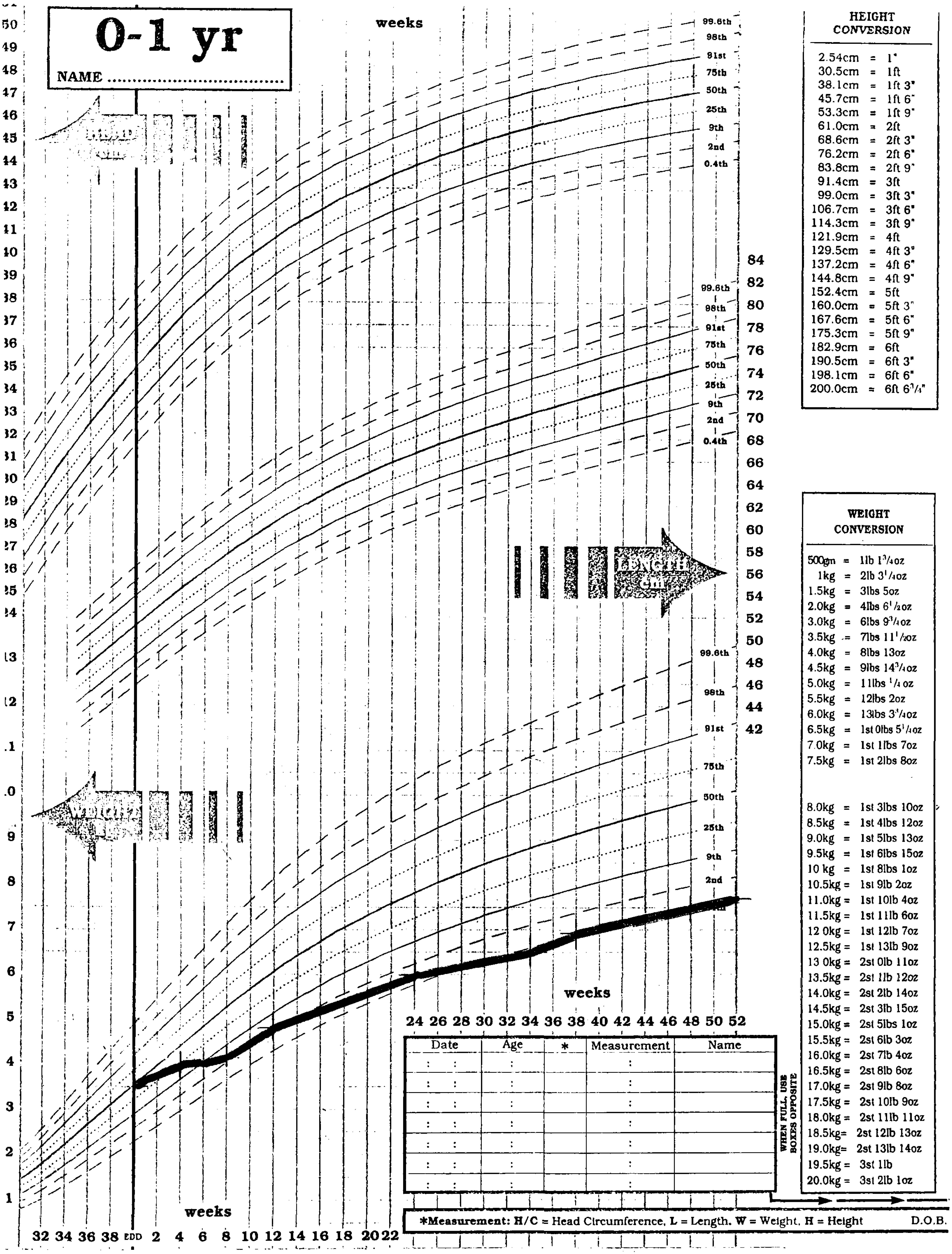


Figure 9.2 shows two scatterplots, one with and one without the extreme point. Removing the point from the data set changes the coefficient for *give* from .36 to .27 (a change of .09), and *child's weight$_{12}$* from –2.31 to –1.65 (a change of –.66), showing that this case has a big effect on the coefficients. However, when this point is taken out of the data set, the result of the regression between *refuse* and *child's weight$_{12}$* is still clearly significant (p=0.0150).

To investigate this idiosyncratic case further, the child's birth weight and subsequent weight records were plotted onto a growth chart shown in Figure 9.3. Growth charts illustrate reference standards derived from growth data compiled from populations of children of different age groups. The data are presented as centiles on separate centile charts for each sex. Separate charts are used for height for age and weight for age, and they each show centiles at selected intervals, including the extreme (e.g. third, fifth, ninety fifth and ninety seventh) and less extreme (e.g. twenty fifth, fiftieth and seventy fifth) centiles. The chart used in Figure 9.3 is based on the UK (1990) growth standards, which are based on measurements made on over 25,000 children between 1978 and 1990, from seven different data sources (Freeman et al., 1995). Extreme growth patterns can be identified by entering measurements onto the charts at intervals. In this case we are interested in weight for age.

The plotted data in Figure 9.3 show that this child's birth weight was close to being on the fiftieth centile (i.e. average for the population). However, his weight gain was subsequently poor and dropped to below the 9th centile relative to the standard within the first eight weeks, and continued to drop over the whole of the first year. At 12 months this child's weight was well below the 2nd centile. Failure-to-thrive refers to children 'who fail to gain weight adequately and therefore do not achieve a normal or expected rate of growth' (Whitten et al., 1969). There are different criteria for diagnosing failure-to-thrive. One conventional definition of non-organic failure-to-thrive (NOFTT) is 'weight faltering down across centile lines to a point below the third centile on standardised weight charts and (that lasts) for a period longer than six months and in the absence of any organic disease which might explain such loss' (Harris, 1993). From having had several conversations with the mother, it was clear that she considered her child to be healthy. Assuming this is correct, as it is for most children who fail to thrive, the child shows a growth pattern which clearly meets the criteria for non-organic failure-to-thrive. This case has important implications for the type of data collected when studying eating behaviour. The mother was feeding her child directly (measured by *gives*) at a far higher rate than all the rest of the sample of mothers, and the child was refusing the food. The count of *feedself* for this child was also very low (four times during meal 1 and five times during meal 2). The child, then, was *given* food from the mother which he *refused* to a large extent, and did not feed himself either. The mother was very emphatic during normal conversations that her child enjoyed many different kinds of food, and had a very good appetite. The mother's responses on the Child Feeding Questionnaire were that he was 'easy to wean', 'easy to feed', 'has a good appetite' and 'eats most things'. This case highlights the importance of obtaining objective, behavioural data rather than parental reports which would not have identified the child's eating behaviour as unusual.

Figure 9.3 Plotted weight records from birth of idiosyncratic case (AJ)



The fifth purpose of the study was to relate weight gain to the child's observed eating behaviour at 12 months. In this section body weight at 18 months is related to the child's observed eating behaviour at 12 months and to weight at 12 months, to investigate whether eating behaviour predicts weight gain.

The results from relating body weight at 12 months with eating behaviour showed that refusing food was negatively related with body weight. The next section of analysis investigated this relationship and other variables prospectively. The coefficients from a series of regressions of *child's weight*$_{18}$ on predictor variables (*duration*, *intake*, *accept*, *refuse*, *reject*, *feedself* and *child's weight*$_{12}$) can be seen in Table 9.7. The table shows that *duration*, *intake, accept*, *reject* and *feedself* are not related to body weight at 18 months. However, *refuse* is negatively related with body weight at 18 months. As would be expected, there is a strong relationship between body weight at 12 months and 18 months.

In order to determine whether the relationship between *refuse* and *child's weight*$_{18}$ is independent of *child's weight*$_{12}$, the regression of *child's weight*$_{18}$ on *duration*, *intake*, *accept, refuse*, *reject* and *feedself*, and then repeated with *child's weight*$_{12}$ in a second step was calculated. Table 9.8 shows the coefficients from the regressions. Table 9.8 shows that the relationship between *refuse* and *child's weight*$_{18}$ is statistically significant which is consistent with the finding that *refuse* was related to *child's weight*$_{12}$. However, when *child's weight*$_{12}$ is taken into account statistical significance is lost. This shows that the relationship at 18 months is mainly due to the fact that *refuse* and *child's weight*$_{12}$ is significantly related, and *child's weight*$_{12}$ is strongly predictive of *child's weight*$_{18}$.

Table 9.7 Coefficients from the bivariate regressions of *child's weight*$_{18}$ (kg) on variables (*duration* (mins), *intake* (g), *accept*, *refuse*, *reject*, *feedself* and *child's weight*$_{12}$ (kg))

	B	SE B	*p*
Child's weight$_{18}$			
Constant	12.16	.40	
Duration	–.03	.02	.1176
Child's weight$_{18}$			
Constant	10.71	.38	
Intake	.01	.00	.0761
Child's weight$_{18}$			
Constant	11.16	.32	
Accept	.01	.01	.1548
Child's weight$_{18}$			
Constant	11.98	.18	
Refuse	–.04	.01	.0016
Child's weight$_{18}$			
Constant	11.57	.18	
Reject	.00	.05	.9458
Child's weight$_{18}$			
Constant	11.73	.22	
Feedself	–.01	.01	.3666
Child's weight$_{18}$			
Constant	.81	.47	
Child's weight$_{12}$	1.06	.05	.0000

Table 9.8 Coefficients from the regression of *child's weight*$_{18}$ (kg) on variables observed at 12 months (*duration* (mins), *intake* (g), *accept, refuse, reject* and *feedself*), with the addition of *child's weight*$_{12}$ (kg) in a second step

	B	SE B	*t*	*p*	*F* change	*p*
Constant	11.64	.55				
Duration	.01	.03	.22	.8240		
Intake	.01	.00	1.75	.0841		
Accept	−.01	.02	−.77	.4465		
Refuse	−.04	.01	−2.84	.0056		
Reject	.06	.05	1.14	.2595		
Feedself	−.01	.01	−1.42	.1594	2.92	.012
	B	**SE B**	***t***	***p***	***F* change**	***p***
Constant	.83	.57				
Duration	−.01	.01	−.45	.6525		
Intake	.00	.00	−.18	.8611		
Accept	.01	.01	1.03	.3065		
Refuse	−.00	.01	−.51	.6140		
Reject	.00	.02	.08	.9402		
Feedself	.00	.00	.59	.5553		
Child's weight$_{12}$	1.05	.05	20.57	.0000	423.26	.000

Summary

Investigating whether there is evidence for differences in boys and girls in aspects of the meal and eating behaviour showed that there are only two differences. One is that boys' food *intake* is higher than that of girls, and the other is that the ratio *p.accept* is statistically higher for boys. However, further analysis showed that the difference in *intake* is not due to differences in eating behaviours leading to the speculation that boys have larger mouthfuls than girls. The possibility that the difference is due to boys being heavier and taller than girls on average (rather than a sex effect per se) was investigated. The sex difference remained when height and weight were taken into account, although it just misses statistical significance. This indicates that higher intake in boys cannot be fully accounted for by the fact that they are heavier and taller than girls. Analysis showed that there are no differences in mothers' behaviour or verbal comments according to the sex of the child.

The analyses investigating the child's body weight and eating behaviour found no evidence that fatter children have a faster bite rate than thinner children, or shorter meal durations. Only one of the variables is statistically significantly related to the child's body weight; the results show that body weight at 12 months is negatively related to refusing food. This remains the case when the number of *gives* is taken into account, showing that higher body weight children *refuse* food the least often. One extreme case was identified as *refusing* food at a far higher rate than all the other children. On looking at the child's weight gain over the first year, the child met the criteria for NOFTT. Even though this case was shown to have a strong influence on the results, the effect of children with higher body weights refusing food less often was still evident when the extreme case was removed from the data set.

The analyses examining observed eating behaviour at 12 months to determine whether it predicts body weight at 18 months showed that none of the variables, except for *refuse*, is associated with body weight at 18 months. However, this statistically significant effect is due to the relationship existing at 12 months, and weight at 12 months strongly predicting weight at 18 months.

Chapter Ten

Discussion

Aims of the study

The broad aim of the thesis was to investigate a neglected area of behavioural research - feeding behaviour in late infancy - and in doing so to answer five questions. Specifically, the aims were (1) to describe eating behaviour in late infancy, and analyse the interaction that takes place between mother and child during mealtimes; (2) to investigate relationships between mothers' child feeding practices and their child's observed eating behaviour; (3) to investigate whether mothers' scores on the restraint and disinhibition subscales of the Three-Factor Eating Questionnaire are associated with child feeding practices; (4) to investigate whether there are any sex differences in eating behaviour, and whether boys and girls are treated differently at mealtimes and (5) to investigate whether children's eating behaviour is associated with their body weight at the time of observation, and then prospectively at 18 months.

Description of eating behaviour

Very little research on behavioural aspects of mealtimes has been conducted during the period of late infancy during which the child is being weaned. One purpose of the design of the study was to examine the structure of one-year-olds' meals. A few studies have investigated the mothers' and child's behaviour during mealtimes (e.g. Klesges et al., 1983; Koivisto et al., 1994). However, Klesges et al. only observed 14 subjects of children with an age range of two years. The importance of statistical power in planning any study cannot be overstated; there is little point in conducting studies which do not detect real effects due to an insufficiently large sample. This study observed 100 mother and child pairs, so power was very high (e.g. >90% chance of detecting a correlation of 0.32, at $p<0.05$, two-tailed) which increased the chances of detecting relationships that exist and also confidence in the results. Koivisto et al. studied a larger sample of 50 children, but the age range was four years. The present study kept the age range of the children observed within two calendar months which provided very representative data on the feeding behaviour of one-year-olds. The data collected for the study were coded in a way that made it possible to separate the eating behaviour into the savoury and sweet sections of the meals.

As expected, most mothers served their child savoury foods first followed by a dessert. Two differences between the two types of food were observed. First, the texture of savoury foods almost always fell into the *solid* category whereas sweet foods were fairly evenly divided between the *purée* and s*olid* categories and some were *semi-solid* (page 151 Table 7.12). This was a result of mothers serving their child yoghurt, fromage frais or other pre-packaged desserts which come in purée form, such as Munch Bunch Pot Shots, Petits Filous Frubes and Nestlé Milky Bar White Chocolate Dessert. Second, on average larger portions of savoury than sweet foods were served (page 152 Table 7.13). This may reflect the fact that mothers assume their child will be hungrier at the beginning of the meal when savoury foods are usually being served. Another explanation might be that mothers prefer their child to eat savoury foods and feed them according to the child's appetite, but do not do this for sweet foods. The reason for the differences in texture and portion sizes of savoury and sweet foods might also be related in some ways. The child was often given pre-packaged sweet foods (e.g. yoghurt, fromage frais, mousse) and not only are these foods often of purééd consistency, but the serving in a sense is predetermined by the size of the carton rather than by the mother.

There was no meal-to-meal consistency in the amount of savoury food or sweet food served (ρ=0.17 and ρ=0.20 respectively) (page 152 Table 7.13). This raises the possibility that mothers, while probably being unaware of the mechanisms of energy intake control in young children, are quite aware that the amount of food children eat varies from one meal to another, and they cater for this by serving different quantities of food at different times accordingly. However, there are other possibilities. For example, the quantity of food the mother serves may be dictated by the food she has available. Or she may be trying the child with a new food and cannot predict whether her child will like it, and so serves a small amount to avoid the possibility of it being wasted. Any of these explanations could account for the fact that different amounts of savoury and sweet foods were served at the two meals.

Food intake was unimodally distributed for savoury foods whereas it was bimodally distributed for sweet foods (page 164 Figure 7.22). Sweet foods were often pre-packaged and served straight from the package, e.g. fromage frais. The child would usually be given as much as the child wanted from the pot, but would usually not get any more if this was finished, which may explain a bimodal distribution for sweet foods with modes at 40g and 80g.

The study used video recorded observational data, stringent pre-specified criteria for the beginning and end of a meal and a coding procedure that included automatic time recording. These features, and the fact that data were collected from two meals each from a large sample of children, provided very accurate information about the duration of meals (page 116). The median duration of meals in 12-14 month children is 18.9 minutes (semi-interquartile range 13.3 to 22.8 minutes). This result is similar to that of Reau et al. (1996) who reported that 10½-13½ month children had a median meal duration of 18.5 minutes (semi-interquartile range 14.5 to 22.1 minutes) and 13½ to 16½ month children a median meal duration of 17.4 minutes (semi-interquartile range 12.8 to 26.6 minutes). This similarity is perhaps surprising since their data depended on recall by parents.

There is some evidence that meal duration might be a feature of meals of infants who are failing to thrive. Mathisen et al. (1989) video recorded one lunchtime meal of a sample of 9 NOFTT and 9 control infants. They found a significant difference in the time taken to feed infants according to whether or not they were diagnosed as NOFTT; the cases took just 8.5 minutes over their meal whereas the comparison group took 21.1 minutes. However, Heptinstall et al. (1987) observed the meals of two groups of 4 year old children as they ate in their own home (*n*=23 in each group) and found no significant difference in meal duration across the groups; the cases took 24 minutes to feed, and the controls 17 minutes. It is not possible to draw firm conclusions about FTT and meal duration from these studies because Mathisen et al. (1989) do not specify their criteria for the beginning and end of a meal. Heptinstall et al., on the other hand, specified that the meal began as soon as food was offered to the child irrespective of whether or not the child began to eat immediately, and finished when the child had eaten all the food, wandered off, refused to eat any more or the mother removed the plate. This highlights the importance of specifying the criteria for the beginning and end of a meal so that results from different studies can be interpreted and assessed. An important application of measuring meal duration in normal samples of children is that it allows comparisons across groups of children with different conditions, such as failure to thrive and cerebral palsy, to be made.

On average, approximately twice as long is spent eating savoury foods as sweet foods; the median duration for savoury food eating over the two meals is 11.6 minutes (semi-interquartile range 8.5 to 14.8 minutes) and 5.9 minutes (semi-interquartile range 4.6 to 8.0 minutes) for sweet food eating (page 160 Table 7.16). However, because more savoury food is served, it might be expected that longer is taken over eating it. Meal-to-meal consistency between the duration of savoury food eating is statistically significant whereas that for sweet food eating is not. The lack of meal-to-meal consistency in the duration of eating sweet foods may reflect the fact that the food texture was more variable for sweet than savoury foods. For example, at one meal the child may have been served a piece of fruit and at the other a fromage frais. Gisel (1991) showed that puréed foods took the least time to swallow and solid foods the longest, which might explain this finding.

In children of this age both the mother's and child's behaviour contribute towards food intake during the child's meals. One-year-olds are at a behavioural transition - they may have progressed to adult-type foods but in the majority of cases getting the food into the child's mouth is a result of the combined efforts of mother and child (page 127 Figure 7.1). A meal-by-meal and course-by-course analysis showed that at each meal, and for savoury and sweet foods separately, there were a few children at each extreme but the majority combined self feeding and being fed by the mother (page 128 Figure 7.2, page 153 Figure 7.16 and page 155 Table 7.14).

The extent to which the child is fed by the mother and the extent to which it self feeds during meals can be quantified using *p.fdself(a)*, the ratio of *feedself* to *feedself* and *give*. The correlation of *p.fdself(a)* across the meals was moderate, showing a degree of within-subject consistency from meal-to-meal (ρ=0.41) (page 129 Figure 7.3). When *p.fdself(a)* was analysed for within-subject consistency across the savoury and sweet sections of the meals, the correlation between the two ratios was moderately high (ρ=0.50) (page 155 Figure 7.17). A child who self feeds, then, does so regardless of when the food is served and whether the food being eaten is savoury or sweet. The importance of observing more than one meal per child has been shown; analysing the proportion a child feeds itself across the two meals shows that there are some children who are fed by the mother almost entirely at one meal and then self feed at the other.

P.fdself(b), the ratio of *feedself* to *feedself* and *accept*, measures the extent to which food that enters the child's mouth is a result of self feeding. The distribution of scores for *p.fdself(b)* covers the whole range of scores relatively evenly for the meals as a whole and for the savoury and sweet sections of the meal. This shows that there is no typical extent to which the proportion of mouthfuls of food a one-year-old has are from self feeding (page 130 Figure 7.4 and page 156 Figure 7.18).

When a child is given food directly from the mother, the variable *p.accept* measures the extent to which a child *accepts* the food rather than *refuses* it. *P.accept* is the ratio of *accept* to *accept* and *refuse*. The distribution of scores for *p.accept* show that when mothers *give* food, in general children *accept* a higher proportion of food than they *refuse* (page 133 Figure 7.7) and this is true for savoury and sweet foods when analysed separately (page 159 Figure 7.21).

In cases where a child does not feed itself, this can be the result of not being capable of, not wanting to, or not being allowed to. The Weaning and the Weaning Diet Report (Department of Health, 1994) states that 'behaviour during weaning can be exasperating with refusal of food, spitting it out, sicking it up, tipping it over, dipping hands in it, squeezing and smearing it, wanting more, demanding something else, or a faster or slower supply'. Inevitably the mother's attitudes towards self feeding will shape the child's ability and experience to some extent; a child who is allowed to attempt self feeding will usually learn how to quicker than those who are not. From observing the mealtimes, it was noticed that mothers' level of tolerance of the behaviours mentioned in The Weaning and the Weaning Diet Report varied widely. It was fairly unusual for a child not to attempt to feed itself at all; in most cases children who were not self feeding at all were discouraged to do so by the mother. Other mothers appeared to be concerned that the child ate with a spoon and discouraged finger feeding, which made eating much more difficult for the child; eating with a spoon is a complex task entailing the problems of controlling the spoon in the hand, loading food onto it, transporting the loaded spoon to the mouth without spilling, and emptying the food into the mouth (Connolly and Dalgleish, 1989).

Although some mothers discouraged self feeding, others were at the opposite end of the spectrum and handed food to the child during meals to facilitate self feeding. The behavioural code *hand* records this behaviour in the mother and the code *feedself* records the child feeding itself. The correlation between the counts of *hand* and *feedself* was 0.37 for the meals as a whole (page 130), and 0.44 and 0.40 for the savoury and sweet sections of the meal respectively (page 157 Table 7.15). These correlations show that the mother handing food to the child is related to self feeding. *P.hand(a),* the ratio of *hand* to *hand* and *give,* measures the extent to which mothers hand food to their children to facilitate self feeding rather than feed directly. *P.hand(b),* the ratio of *hand* to *hand* and *feedself,* measures the extent to which self feeding is facilitated by being handed food. The majority of scores for *p.hand(a)* and *p.hand(b)* was zero, showing that most mothers feed their child directly, and most self feeding is not facilitated by the mother handing the child food (page 131 Figure 7.5 and page 132 Figure 7.6). Similar findings were shown for both savoury and sweet foods (page 158 Figure 7.19 for *p.hand(a)* and page 158 Figure 7.20 for *p.hand(b)).*

The total number of bites taken and meal duration was positively associated for the meals as a whole (page 134 Figure 7.8) and for savoury and sweet foods when analysed separately (page 161). The quantity of food consumed during the meals was also positively associated with the total number of bites taken for the meals overall (page 138 Figure 7.11), and for savoury and sweet foods when analysed separately (page 166 Figure 7.23). As the child takes in more bites of food, then, the duration of the meal and food intake increases. However, the duration of meals was negatively associated with food intake when the number of bites was taken into account (page 140 Table 7.5). The regression showed that for a meal of a given number of say 60 *bites*, on average a child would take in 191 g of food during a meal lasting 10 minutes, and only 159 g during one lasting 20 minutes. In other words, *intake* per *bite* is lower during longer meals. When the duration of the meal, food intake and the number of bites were analysed separately for savoury and sweet foods (page 167 Table 7.21), the relationship for savoury food mirrored those for the data set as a whole; there is a negative relationship between *intake* and *duration* so that children taking longer over savoury foods had a lower savoury food *intake* per *bite*. However, this relationship was not statistically significant for sweet foods.

Reau et al. (1996) showed that for toddlers (children between 13-27 months old), the three most commonly reported problems are 'not always hungry at mealtimes', 'trying to end meals after a few bites' and 'picky eating'. Of these, only picky eating was associated with lengthened feeding time. The findings of Reau et al. and this study are not directly comparable as Reau et al.'s were based on parental reports. They had no clear definition for 'picky' and without knowing how parents interpret the term 'picky' it is only possible to speculate on the behaviours they referred to which are associated with the longer meal durations. One reasonable assumption is that parents use this term to refer to a child who they believe has not eaten much food during the meal. The present study has shown that longer meals are associated with a lower *intake* per *bite*. This may be what parents describe as picky eating. If this is the case, then it is only found for savoury food eating, and may be a reflect food preferences.

There is evidence that the characterisation of picky eating is important. Marchi and Cohen (1990) conducted a longitudinal study in a sample of over 800 children at three time-points: when the children were of mean age 6 years (range 1-10 years), 14 years (range 9-19 years) and 16 years (range 11-21 years). Mothers were interviewed on the child's eating behaviours and the presence of specific eating disorders. They were asked to rate six eating behaviours: meals unpleasant; struggle over eating; amount eaten; picky eating; speed of eating; and interest in food. Picky eating was defined as 'does not eat enough, is often or very often choosy about food, usually eats slowly and usually not interested in food'. A child had to be rated as having three of these four characteristics to be referred to as a 'picky eater'. The results provided evidence that picky eating in early childhood is associated with extreme symptoms of anorexia nervosa in adolescence, making this an important area of research.

There are two ways in which a child can consume food: by self feeding or accepting food from the mother. Of the two, accepting food from the mother is far more effective than self feeding in getting food into the child's mouth (page 142 Table 7.7). For example, on average during a meal where the child <u>accepts food</u> from the mother 30 times, the child's food intake is 130 g and an additional 3 g for every extra time the child accepts food. This can be compared to a meal where the child <u>feeds itself</u> 30 times. In this case on average the child's food intake is 54 g and an additional 1 g for every extra time the child self feeds. Very similar relationships were found for both meals when analysed separately (page 143 Table 7.8) and for both savoury and sweet foods (page 170 Table 7.24). Adequate food intake is as important at this time as any other, making the implications of this finding important; children must learn the behaviours associated with achieving food intake in order to become fully independent at mealtimes, and need time and practice to learn the skills of self feeding. The mother, then, must allow the child to feed itself to enable the child to learn. However, it is equally important that the mother ensures that food intake is adequate and the child's appetite satiated by simultaneously feeding the child herself. The data show that many mothers do this but there might be cases (such as infants with poor weight gain), where it would be particularly desirable for a mother to feed her child, at least for a while, to increase food intake.

The relationship between the duration of a meal, accepting food from the mother and self feeding shows that during the meals overall, and during savoury and sweet food eating when analysed separately, self feeding is associated with slightly longer meals than accepting food from the mother (page 136 Table 7.3 and page 163 Table 7.19). Considering that one-year-olds are learning to self feed, which might be assumed to take much longer, the difference in *duration* according to whether the child was accepting food or self feeding is fairly marginal.

In most cases one-year-olds are fed directly by the mother at least to some extent. This was recorded using the code *give* which describes the mother putting food directly to the child's mouth, and the child's response is either to *accept* or *refuse* it. Refusing food could be an important means of controlling food intake for the child who is not feeding independently; the child cannot control the number or timing of *gives*, but can control whether the food the mother *gives* is consumed or not. The count of turning down food and food intake are negatively related when the number of times the mother *gives* food is taken into account (page 146 Table 7.10). For example, for a given number of say 40 *gives*, during a meal where a child turns down food 5 times the child consumes 200 g on average, whereas a child who turns down food 10 times consumes 165 g on average. Similar results were found when the relationship was examined for the savoury and sweet sections of the meal, (page 173 Table 7.26). So, for a given number of *gives*, regardless of the type of food being served, the more times the child *turns down* food, the more *intake* is reduced. This suggests that children are very active in controlling their food intake.

Very few children indeed left little or no food at the end of both meals (page 148 Figure 7.15), suggesting both that mothers tend to serve more food than the child eats, and confirming that children are very active in their control of food intake at least in so much as they do not passively eat all the food served to them. The difference in the distribution of scores for leftover food for savoury and sweet foods is interesting. Although both distributions are positively skewed, few children left no or little savoury food, (for example, only 26 children left an average of less than 30 g over the two meals), while the majority of children left little or no sweet food (for example, 67 children left an average of less than 30 g over the two meals) (page 176 Figure 7.27). This may by a consequence of differences in the quantity of the portions served between savoury and sweet foods. On average mothers served more savoury foods, of which relatively larger quantities were left uneaten at the end of the meal than sweet foods (on average 65 g less). In general, what was served in the way of sweet foods, was eaten. Savoury foods were usually served at the beginning of the meal, so the fact that savoury food was often left but sweet foods were not might demonstrate sensory specific satiety; a child who has had enough of one food goes on to eat another. This is evidence that feeding children is not simply a question of serving foods to appetite - the type of food and when they are served are also important. Birch and Deysher (1986) have shown that short-term food preferences decrease for foods just eaten. They have not investigated whether a short-term decrease in food preference affects actual food intake in children, although other researchers have shown that sensory specific satiety reduces food intake in adults. It follows that if food intake is similarly affected in children, then a child who is provided with a wide variety of foods will eat more than one who is not.

In summary, the median duration of one-year-olds' meals have been quantified as being nearly 19 minutes, but with almost two thirds of that time being spent eating savoury foods and one third on sweet foods. The behavioural transition of one-year-olds has been clearly identified in that the majority are both being fed by the mother and feeding themselves during mealtimes. The importance of observing more the one meal per child has been shown due to wide individual variable across the meals in self feeding. Self feeding is only slightly slower than accepting food from the mother. Longer meals are associated with a lower *intake* per *bite*. This could be what parents describe as 'picky eating'; if so, then this is only shown for savoury food eating. In terms of quantity of food intake, by far the most effective way of getting food into the child is for the mother to feed it. Food intake decreases as the number of times the child turns down food increases. Very few children leave no food at the end of both meals, showing that mothers serve more food than the child will eat, and that children only eat a proportion of the food served to them. However, it is much more usual for little or no sweet foods to be left uneaten after the meals than savoury foods. It is clear that children have a very active role in the control of food intake independent of the mother's behaviour.

Mothers' child feeding practices and observed child eating behaviour

There is evidence that relationships exist between parental characteristics and children's ability to calorie compensate (Johnson and Birch, 1994). Johnson and Birch (1994) reported that parents who indicated the highest levels of self-reported control in the feeding situation had children who were the least able to calorie compensate. Although the questions asked were not published at the time, a recent publication described them as questions about the extent to which control was exerted over what, when and how much children could eat (Birch, 1998). The authors, however, reported that they summed the responses from the Child-Feeding Questionnaire items *that significantly correlated with children's COMPX scores* to produce a parental control index. Analysing the data in this way was bound to show that mothers who exercise more control in the feeding situation have children less responsive to the energy density of preloads, so the results may be misleading.

Other research has shown that encouraging the child to focus on aspects such as the amount of food left on the plate, rather than the sensation of hunger, upsets the child's ability to calorie compensate (Birch et al., 1987). There is evidence that getting a child to eat food in order to get a reward reduces the child's preference for that food (Birch et al., 1984) and using food as a reward increases preferences for that food (Birch et al., 1980). Koivisto et al. (1994) observed children's mealtimes and showed a relationship between children's energy intake and 'taking food on the recommendation of the parent'.

One of the suggestions of the thesis is that the mother is of central importance in the process of weaning. The second purpose of the study was to investigate relationships between the mothers' child feeding practices and the child's observed eating behaviour. The mothers' comments to her child during meals were included in the analysis.

As might be expected, mothers who offer food behaviourally (measured by *give*) also offer food verbally. With the exception that *refuse* and *non-food comments* are significantly related, none of the variables relating to the mother are associated to the child's mealtime variables.

The present study is not directly comparable to previous research because it did not measure caloric compensation or energy intake, but rather analysed the data for relationships between the mothers' child feeding practices and children's eating behaviour. The data for the present study do not provide any evidence to support the suggestion that mothers' child feeding practices are related to the child's eating behaviour. It must be noted, though, that the data for Birch's body of research are from pre-school children and Koivisto et al.'s from 3-7 year old children. The data for the present study, on the other hand, investigates a younger age group of children and it is possible that relationships between mothers' child feeding practices and children's eating behaviour do not exist until children are over the age of one year.

Mothers' self-reported eating characteristics and child feeding practices

Johnson and Birch (1994) measured mothers' self-reported eating characteristics using the TFEQ and found that girls with mothers with high levels of restraint tended to demonstrate more precise caloric compensation than girls with mothers with low levels of restraint. In the same study, children of parents with high levels of disinhibition also demonstrated less precise caloric compensation than those of parents with low levels of disinhibition. The authors suggest three possibilities for this last relationship: the role models the parents provide, genetic influences and differences in the way the children are fed. The present study investigated the last of these suggestions. The third aim of the study was to determine whether mothers with differing levels of restraint, disinhibition and/or hunger treat their children differently in the feeding situation. On examining the relationship between the scores on the subscales, it was shown that mothers' *restraint* is positively related to *disinhibition* and *disinhibition* is positively related to *hunger* (page 189 Table 8.3)

The amount the mother *gives* food directly to the child's mouth and the amount she *hands* food to the child to facilitate self feeding, are unrelated to the mothers' self-reported eating characteristics (*restraint*, *disinhibition* or *hunger*) (page 190 Table

8.4). There are also no relationships between the mothers' verbal comments and self-reported eating characteristics (page 191 Table 8.4). The mothers' verbal and non-verbal behaviour did not differ according to the child's sex (page 190 and 191, Table 8.4). Analysis also showed that the mothers' self-reported eating characteristics were not related to the child's observed eating behaviour (page 192 Table 8.5). Johnson and Birch (1994) related the mothers' self-reported eating characteristics to the child's ability to calorie compensate, whereas the present study examined the mothers' responses to the questionnaire in relation to her verbal and non-verbal behaviour during children's meals. The data from the present study provide no supporting evidence for the suggestion that mother's self-reported eating characteristics are related to child feeding practices or that girls are treated differently at mealtimes.

Restraint and *disinhibition* are themselves related to BMI (page 189 Table 8.3) so the mothers' BMI (entered as weight and height^2 separately in regressions) was also analysed for relationships between it and child feeding practices (page 194 Table 8.6), since there is otherwise obviously a danger that a BMI effect will be confounded with a *restraint* or *disinhibition* effect. Analysis showed that mothers' behaviour and verbal comments are unrelated to the mothers' weight and height. The only exception is that *give* is related to *mother's weight* and this relationship remains when the child's response to *give* is taken into account (page 195 Table 8.7) so that mothers with the higher body weights *give* food to their child the most often (page 196 Figure 8.1). It was very striking that the three most severely obese mothers each gave their child food well above the average number of times, and more times than any other mother in the sample, raising the possibility that obese mothers use different child feeding practices to non-obese mothers. There are various possibilities why this might be the case. For example, obese mothers have unrealistic expectations of children's energy requirements or appetite. It is surprising, perhaps, that this finding is totally unrelated to the variables *restraint* and *disinhibition*, given that both are positively related to BMI.

The finding that mothers with higher body weights *give* food more often than those with lower body weights may provide indirect support for two studies. The first is that parental control over children's eating has been shown to be negatively related to the ability to calorie compensate (Johnson and Birch, 1994). It is possible that continuing to *give* food is one way in which parents upset the ability to control energy intake accurately. The second is that parental prompts to eat (defined as presenting and offering food and encouraging its consumption) have been shown to be associated with relative weight in children ranging from 12-36 months (Klesges et al., 1983). Interestingly, Klesges et al. found evidence of actual feeding strategies being linked with obesity; the three children at the national mean (49th, 50th and 52nd percentile) of weight controlled for height and sex received no encouragements to eat or food offers during each feeding session. In contrast the two children on the 99th percentile received an average of 30 and 36 encouragements to eat or offers of food during each feeding session. This suggests a strong link between mothers' feeding practices and child body weight. If it were the case that mothers with higher body weight consistently give food at a high rate throughout the child's younger years, this could well result in the child becoming overweight.

Sex and eating behaviour

Johnson and Birch (1994) found that girls with mothers with high levels of restraint tend to demonstrate less precise caloric compensation than girls with mothers with low levels of restraint. This relationship was not found for boys, and the authors suggest that this may be the result of girls and boys being treated differently in the feeding situation. Other evidence from Hill et al. (1990) showing that there is a strong relationship between restraint in mothers and in their 10 year old daughters makes this a plausible argument. Johnson and Birch (1994) also found that boys show the clearest evidence of caloric compensation overall. The fourth purpose of the study was to investigate whether there are any differences in eating behaviour according to the child's sex, and whether boys and girls are treated differently at mealtimes.

The results show that there are no differences in the mothers' behaviour and verbal comments according to the child's sex (page 199 Table 9.1 and page 202 Table 9.4). The only differences in the child's behaviour according to sex is for the variable *p.accept*, with boys accepting proportionally more often than girls. The only other difference is in *intake*; boys' intake was higher than for girls' (page 199 Table 9.1). Further investigation into the variables comprising *p.accept* (i.e. *accept* and *refuse*), showed that the number of times boys accept or refuse food does not account for their higher intake (page 200 Table 9.2). The finding that boys have a higher intake than girls cannot be fully accounted for by the fact that on average boys are heavier and taller than girls either, leading to the speculation that boys have larger bites than girls (page 201 Table 9.3).

Johnson and Birch (1994) found relationships between the ability to calorie compensate and the child's sex. This study examined the child's behaviour and the mother's verbal and non-verbal behaviour. The results show there are no differences in eating behaviour in one-year-olds according to the child's sex and there is no evidence to support the suggestion that girls may be treated differently at mealtimes.

Child body weight and eating behaviour

As discussed in the introduction, the prevalence of childhood overweight is high and increasing (Troiano and Flegal, 1998; Troiano et al., 1995). For example, Troiano et al. (1995) showed that the prevalence of childhood overweight has increased among all sex and age groups between 1963 and 1991. Childhood obesity has been associated with later adverse medical consequences such as cardiovascular and metabolic diseases (Smoak et al., 1987; Voors et al., 1976) and social consequences such as negative stereotyping (Wardle et al., 1995) and low self esteem (Kaplan and Wadden, 1986). According to Bouchard (1996), between 30% to 50% of the variance in adiposity in a population is attributable to genetic influences. However, it is not yet known whether the mechanism by which genetic factors influence body weight is via eating behaviour itself, or the exact role that environmental factors (which must account for 50% to 70% of the variance) have in the development of obesity.

Three approaches to studying eating behaviour and obesity in children have been taken in previous research. The first is identifying possible eating styles associated with being overweight. Two of the most consistent findings are that higher body weight in children is associated with shorter meal durations (e.g. Keane et al., 1981; Nakao et al., 1990) and a faster bite rate (Barkeling et al., 1992; Drabman et al., 1979). The second approach is based on caloric compensation experiments. Johnson and Birch (1994) showed that children with the highest body fat stores are least able to compensate accurately for calories in preloads. The third approach is relating the interaction that takes place during mealtimes to the child's relative weight (Klesges et al., 1983). Klesges et al. found that parental food offers and encouragements to eat were associated with the child's relative weight. The fifth purpose of the study was to relate children's eating behaviour to body weight using a similar design to Klesges et al. (1983). However, the present observed a much larger sample of children whose age was within a narrow range making the results more representative of eating behaviour for children of this age.

There is no evidence that body weight is negatively related to shorter meals as found by other researchers (e.g. Keane et al., 1981; Nakao et al., 1990). However, Nakao et al.'s (1990) study was longitudinal, and an association between meal duration and BMI was not observed before the children were capable of independent self feeding; the association was found at follow-up observations when the children were feeding independently. The results of this study support Nakao et al.'s finding. This suggests that meal duration is not related to body weight before children are feeding independently, possibly due to the mother's role in feeding the child.

There is no evidence that body weight is related to a faster bite rate as shown by other researchers (e.g. Barkeling et al., 1992; Drabman et al., 1979). Israel et al. (1985) showed that bite rate was the same in children regardless of their body weight. This is of note because theirs is the only study which investigated body weight and eating behaviour, and did not observe the children while eating a standardised meal. Instead the children were allowed to choose their own food from the school cafeteria. The present study did not supply standardised meals and the results support Israel et al.'s findings. It is possible that bite rate needs to be studied using composition controlled meals in order to detect differences in children's eating behaviour according to body weight. As with meal duration, bite rate is less straightforward when children are being fed by the mother to some extent; the rate of eating is not just a function of the child's behaviour but of the mother's behaviour as well. Clearly from this study, there is no evidence to suggest that body weight is associated with meal duration or bite rate at one year when being observed while eating non-standardised meals.

Although the rate of eating has been shown to be faster in fatter children (Keane et al., 1981; Barkeling et al., 1992) the former researchers found that the total number of bites was the same in fatter and thinner children, and Barkeling et al. found that total food intake was unaffected by bite rate. The present study supports these findings because the total number of *bites*, and its components *feedself* and *accept* are all unrelated to body weight at 12 months (page 204 Table 9.5). Similarly, there is no relationship between the child's body weight and *intake*.

One of the characteristics of one-year-olds' mealtimes is that mothers usually *give* food to the child directly which the child can either *accept* or *refuse*. The results showed that children with higher body weights *refuse* food less often than those with lower body weights. This remains the case when the number of *gives* is taken into account (page 206, Table 9.6), which is important because the number of times a child r*efuses* food is determined to some extent by the number of times a mother *gives* food to her child; a child who is not *given* food cannot *refuse* it. It is interesting that refusing food is related to body weight at such a young age. The cross-sectional nature of the present study, however, means it is not possible to show a cause and relationship between body weight and this eating behaviour.

One interesting finding was that in observing a normal sample of children, one child's eating behaviour was very unusual in that he refused food far more often than all the others (page 205 Figure 9.1). The child's eating behaviour conflicted with the mother's reports that he was 'easy to feed', 'has a good appetite' and 'eats most things' in response to questions on the Child Feeding Questionnaire. The mother also conveyed during conversations that she was not worried about the child's food intake although her health visitor had expressed concern about his weight gain. This child turned out to have a growth pattern which meets the criteria for non-organic failure-to-thrive (NOFTT).

There is a general consensus that FTT without organic cause is due to malnourishment (e.g. Frank, 1988; Skuse, 1985; Woolston, 1985) although there is very little data on the mealtime behaviour of FTT children and their mothers. Nevertheless there is some previous research which suggests that FTT infants may be difficult to feed. Batchelor and Kerslake (1990) found a greater number of references to feeding problems in the medical notes of children below the 3rd centile on growth charts. Wilensky et al. (1996) studied 50 children with FTT. The mother was given a home visit when the child was 25 months during which data on the infant's feeding history were collected. According to maternal reports, the FTT infants had significantly different feeding histories compared to a control group. The FTT infants tended to fall asleep while breastfeeding more often, slept through scheduled feeding times and refused solids more often. Furthermore, the difficulties were enduring because the children still showed more difficulties related to feeding at 25 months. Kotelchuck and Newberger (1983) studied 42 NOFTT and 42 matched control children under the age of 4 years. All the mothers were interviewed, and the FTT mothers reported that there was a 'problem with feeding' significantly more often than the control group.

Batchelor and Kerslake (1990), Wilensky et al. (1996) and Kotelchuck and Newberger (1983) studied feeding difficulties in FTT children using maternal reports. Other researchers have obtained behavioural data. Iwaniec and Herbert (1982) observed the feeding behaviour of 17 NOFTT children in hospital and compared it to two control groups (mean age 27½ months). They found a variety of feeding difficulties in the NOFTT group. For example, all 17 showed poor sucking, 15 refused to take solids, 12 showed no indication of hunger and 11 took an excessively long time to feed. Heptinstall et al. (1987) observed mealtimes in two groups of 4 year old children, one growth retarded and the other a comparison group (*n*=23 in each). No difference was found in food intake but the mealtimes of the case group reflected a lack of organisation and planning and a more negative attitude. Drotar et al. (1990) observed two groups of 6 month infants and assessed social and feeding behaviour. Each group consisted of 47 infants, one group diagnosed as NOFTT and the other a comparison group. The results showed that mothers of infants with NOFTT terminated feedings with their infants in a more arbitrary manner. However, Drotar et al. did not assess infant behaviour, so they could not determine the extent to which maternal termination of feeding behaviour was a response to infant behaviour. Chatoor and Egan (1983) studied a series of nine case histories from children aged 1-5 years. They claimed that some infants refuse to eat in an attempt to achieve a degree of autonomy and control with regard to the mother.

While data from one child must be kept in context, it is interesting that in the case of the child with an ususual eating pattern in this study, the mother gave the child food directly at a far higher rate than any of the other mothers in the sample. The response of the child was to refuse it, suggesting that it was not the mother failing to feed the child, but rather that the child was exerting control over his own food intake. Certainly from this particular case study it would appear that the child's poor weight gain is a result of the child's eating behaviour.

To my knowledge, there is no previously published prospective study that has investigated the relationship between eating behaviour observed at 12 months and the child's weight gain. Taking a prospective approach has two main advantages. First, using eating behaviour observed at one year to predict weight at 18 months might suggest a cause and effect relationship between weight status and eating behaviour.

For example, if children who have more bites of food during meals at 12 months are heavier at 18 months compared to those who have fewer bites, then this might indicate that children's eating behaviour results in greater weight gain. Second, there is always a problem with observer bias in investigating eating behaviour and body weight at any particular time-point. Although observations of eating behaviour at 12 months may be biased because the observer can determine which children are heavier, observations cannot be biased by the child's future weight gain. In order to investigate the issue of eating behaviour and weight gain, the child's eating behaviour observed at 12 months was related to body weight at 18 months.

The only variable that is related to body weight at 18 months is *refuse* (page 212 Table 9.7). It has already been established that children with higher body weight *refuse* food less often at 12 months than children with lower body weights. However, when the relationship between *refuse* and weight at 18 months was analysed taking weight at 12 months into account, significance was lost (page 213 Figure 9.8). This shows that the relationship at 18 months is mainly due to the fact that *refuse* and weight at 12 months are significantly related, and child's weight at 12 months is strongly predictive of weight at 18 months.

In summary, there is some evidence for differences in eating behaviour according to the child's body weight in this study; children with higher body weight *refuse* food less often. There is no evidence that eating behaviour observed at 12 months is related to weight gain over the following six months.

Conclusions

The transition in infancy from an exclusive milk diet to a mixed one is complex; not only does the child have to make a dietary change but in doing so has to learn to ingest food in a completely new way. Numerous surveys have been conducted concerning when weaning begins and the types of foods infants are weaned onto (e.g. Department of Health and Social Security, 1975; White et al., 1992; Mills and Tyler, 1992). However, the behavioural aspects which accompanies the dietary change have been neglected. The thesis argued that given that this is the infant's first experience with solid foods and that as this is the first period when the mother can affect the kind of eating behaviour that continues into childhood, late infancy may be a very important time in shaping the child's future eating behaviour and dietary intake.

One area of practical importance to which this may be relevant is the aetiology of obesity. Childhood overweight and obesity has been increasing over the last few decades and this trend is continuing. Obesity is associated with adverse medical and social consequences and it is important that genetic and environmental causes are established to facilitate the development of preventative measures for future generations.

The main purpose of the study was to describe feeding behaviour in late infancy, and analyse the interaction that takes place between mother and child during mealtimes. The study shows the contribution both mother and child make to the child's food consumption very clearly; whereas some children at this age are almost entirely fed by the mother and others entirely self feeding, the majority are somewhere between the two extremes. As might be expected, the most effective way of getting food into the child is for the mother to feed it. At this age children need to learn to feed themselves to gain eventual autonomy from the mother, and it is clear that most are attempting to do this. One interesting finding is that children who take longer over meals have a lower *intake* per *bite*. Overall, in looking at children's eating behaviour at one year, the results show that they have an active role in mealtimes; they feed themselves, refuse food and only eat a proportion of the food served to them. In the absence of previous research it was important to suggest how one-year-olds meals can be analysed in future work (page 180). Suggestions were made on how to answer the following questions: How does the mother feed the child? What is the child's response to the mother's feeding behaviour? How independent is the child's feeding behaviour? How efficient is self feeding compared to the mother feeding the child?

The second purpose of the study was to investigate whether mothers' child feeding practices are related to children's eating behaviour. The sample of children observed were very young and newly weaned, and as there is evidence that parents can facilitate the development and maintenance of obesity in their children (Birch, 1980; Klesges et al., 1986) it may be an important time in determining the role of genetic and environmental factors in the development of childhood obesity. The study analysed the mother's behaviour and all the verbal comments she makes to her child during meals, and there is no evidence that relationships exist between mothers' child feeding practices and the children's eating behaviour at this age.

The third purpose of the study was to investigate whether there is any supporting evidence for the suggestion that mothers' self-reported eating characteristics (*restraint* and *disinhibition*) are related to their child feeding practices, but none was found. Mother's BMI was correlated with the subscales of restraint and disinhibition, so BMI was also investigated in relation to child feeding practices. The results show that mothers with the highest body weights *give* their children food more often than mothers with lower body weights. This was very marked in obese mothers, raising the possibility that obese mothers feed their children differently to non-obese mothers. Given that positive relationships were found between *restraint* and *mother's BMI*, and *disinhibition* and *mother's BMI*, it is perhaps surprising that no relationship was found between mother's self-reported eating characteristics and *gives*.

The fourth purpose of the study was to investigate whether there is any evidence that children's eating behaviour differs according to sex, and whether boys and girls are treated differently at mealtimes. Despite finding no difference between the sexes in behaviour, boys had a higher food intake than girls and this is not simply because on average boys are heavier and taller than girls. Having ruled out other possibilities it was speculated that boys might have larger bites which would account for their higher food intake. There were no differences in the way boys and girls were treated.

The fifth purpose of the study was to investigate whether there is any evidence for differences in eating behaviour according to the child's body weight. Neither meal duration nor bite rate was related to body weight providing no support for two of the most consistent findings in the literature. Previous work has found that meal duration is not related to body weight in non-independently feeding children, and bite rate is not found when children are observed eating non-standardised meals, both of which are supported by the results from the present study. However, the child's meal duration and bite rate might be affected because the mother is also involved in the feeding process, and it is possible that bite rate needs to be investigated using composition controlled meals in order to detect differences in eating behaviour.

The children with the highest body weights refused food the least often. The fact that such behaviour is displayed is interesting, and it raises the question of whether it is a genetic or environmental effect. That this is shown in such young children suggests the possibility of a genetic basis for the behaviour, because it might seem unlikely that the environment influences the child's eating behaviour to a significant extent in so short a time. However, the cross-sectional nature of the study does not allow for identification of a directional association.

There is no evidence that eating behaviour observed at 12 months can predict the child's weight gain over the following six months. It is acknowledged, though, that this is a relatively short-term follow-up study, and a longer time between observation and follow-up measurements might be more appropriate in investigating this issue.

The thesis has examined the structure of meals in one-year-olds. The children's eating behaviour and the mothers' verbal and non-verbal behaviour was analysed. Although there is no evidence for differences in mothers' child feeding practices according to the mother's self-reported eating characteristics, no differences in the way boys and girls are treated, and no difference in children's eating behaviour according to the mothers' child feeding practices or the child's sex, there is some evidence that the mother's body weight and the child's body weight are related to eating behaviour. The mother's with the highest body weights gave their child food the most often during meals, and children with the highest weights refused food less often. It is important to note that there is no relationship between the mother's and child's body weight so these latter two findings can be interpreted as separate relationships.

Future research

The present study has examined the structure of meals in one-year-olds. One possible area of future research might be to examine how the structure of meals over the weaning period changes by conducting longitudinal observations. For example, observations could be made of children's mealtimes at one year and followed up for further observations at 18 months and 2 years.

The present study has shown three preliminary findings. The first is that mothers with higher body weights give their children food directly more often than mothers with lower body weights. This was very striking in the group of obese mothers and suggests that obese mothers feed their children differently to non-obese mothers. Potentially this is a very important finding because obesity is known to run in families. This issue could be tackled by conducting a cross-sectional study of obese and non-obese mothers while feeding their child so that particular child feeding practices within groups can be identified.

The second preliminary finding is that a relationship exists between body weight in children and refusing food in children as young as one year. Future research could investigate this issue using a prospective design, to establish whether the child's eating behaviour causes the development of childhood overweight.

The third preliminary finding is that one child whose eating behaviour was unusual was identified as failing to thrive. However, it is not possible to determine from this study whether the child's eating behaviour caused FTT, or whether the child's FTT caused unusual eating behaviour. A prospective study investigating feeding behaviour in young infants, before those who go on to fail to thrive have been identified, might determine the cause and effect relationship between feeding behaviour and FTT in infants.

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Appendix One

Example of letter sent to health centres requesting their support in finding participants

Dear Sir,

I am reading for a PhD at Durham University. The research project I plan to conduct involves studying feeding in one year old children and the way in which they interact with their parents at mealtimes. Through this study we hope to gain a greater understanding of healthy child feeding behaviour in ordinary families which will enable us to help more with children who have feeding difficulties.

This study is purely observational using video recordings of two meals per child for subsequent analysis with no invasive procedures. I will use questionnaires to measure some behaviours and general information relating to the study. I will also ask the mothers to help me to weigh and length their child in their own home. I have been trained in these procedures at the Endocrinology Clinic at the RVI, Newcastle upon Tyne.

Having gained ethical approval, I am now in a position to begin data collection. With this in mind, I am writing to ask whether it might be possible to use Fell Cottage Surgery's Tuesday afternoon baby clinics to approach mothers who have young children. The procedure I have in mind would be for me to approach mothers and invite them to take part in a study on children's feeding behaviour. If they indicated they were willing to participate, I would arrange a home visit at their convenience. I would not ask them for written consent at this first meeting but at a later stage after they have had time to think it over. This procedure can be modified, however, if you are not happy with it in any way or have any other suggestions.

I would very much like to be able to use Fell Cottage Surgery's baby clinic as a potential source of participants and would be grateful if you could bring my request to the attention of the partners at the next Practice Meeting for their consideration. I enclose a copy of a letter from Gateshead Local Research Ethics Committee granting ethical approval for my research project.

If you have any queries about this project or require any further information, please do not hesitate to contact me (374 7780) or my colleague Dr. Drewett (374 2612).

I look forward to hearing from you in due course.

Yours sincerely,

K.N. Parkinson (Mrs).

Appendix Two

Information sheet for participants

Kathryn Parkinson
University of Durham
South Road
Durham DH1 3LE

CHILD FEEDING PROJECT

I would like to invite you and your child to take part in a study of feeding in one year old children and the way in which they interact with their parents at mealtimes. Through this study, we hope to gain a greater understanding of healthy child feeding behaviour in ordinary families which will enable us to help more with children who have feeding difficulties.

Taking part in this study will initially involve my visiting you at home to explain the study and discuss any points you would like to raise. I will ask you to complete two questionnaires - one about your own eating behaviour and the other about your child's feeding behaviour and related issues. I will also ask you for any weight records you have of your child since birth.

I would then like to arrange to come to your home to make video recordings of two mealtimes when your baby is aged about one year old. I would also like you to keep some records about your child's food intake during the three days preceding this visit. I will ask you to help me weigh your child using some portable scales, and to measure your child's height using a Kiddimetre.

If at any time you would like more information about this study please do not hesitate to contact either myself (Tel. 0191 374 7780) or my colleague Dr. Robert Drewett (Tel. 0191 374 2612) of Durham University.

If you wish to participate I will ask you to sign a consent form. Obtaining signed consent is routine for all studies; it does not oblige you to participate, and you will be free to withdraw from the study at any time.

I would like to reassure you that the aim of the study is solely to describe the variety of mealtime patterns found in ordinary families. I will not be asking you to change your child's mealtimes in any way. All information collected during this study will be kept confidential.

Many thanks,

Kathryn Parkinson (Mrs).

GHD/KNP/DUR/1996

Appendix Three

Three-Factor Eating Questionnaire

EATING QUESTIONNAIRE

KNP/DUR/1996

Part I

Directions: Please tick the correct box.

	True	False
1. When I smell a sizzling steak or see a juicy piece of meat, I find it very difficult to keep from eating, even if I have just finished a meal.	☐	☐
2. I usually eat too much at social occasions, like parties and picnics.	☐	☐
3. I am usually so hungry that I eat more than three times a day.	☐	☐
4. When I have eaten my quota of calories, I am usually good about not eating any more.	☐	☐
5. Dieting is so hard for me because I just get too hungry.	☐	☐
6. I deliberately take small helpings as a means of controlling my weight.	☐	☐
7. Sometimes things just taste so good that I keep on eating even when I am no longer hungry.	☐	☐
8. Since I am often hungry, I sometimes wish that while I am eating, an expert would tell me that I have had enough or that I can have something more to eat.	☐	☐
9. When I feel anxious, I find myself eating.	☐	☐
10. Life is too short to worry about dieting.	☐	☐
11. Since my weight goes up and down, I have gone on reducing diets more than once.	☐	☐
12. I often feel so hungry that I just have to eat something.	☐	☐
13. When I am with someone who is overeating, I usually overeat too.	☐	☐
14. I have a pretty good idea of the number of calories in common food.	☐	☐
15. Sometimes when I start eating, I just can't seem to stop.	☐	☐
16. It is not difficult for me to leave something on my plate.	☐	☐
17. At certain times of the day, I get hungry because I have got used to eating then.	☐	☐

	True	False
18. While on a diet, if I eat food that is not allowed, I consciously eat less for a period of time to make up for it.	☐	☐
19. Being with someone who is eating often makes me hungry enough to eat also.	☐	☐
20. When I feel blue, I often overeat.	☐	☐
21. I enjoy eating too much to spoil it by counting calories or watching my weight.	☐	☐
22. When I see a real delicacy, I often get so hungry that I have to eat right away.	☐	☐
23. I often stop eating when I am not really full as a conscious means of limiting the amount that I eat.	☐	☐
24. I get so hungry that my stomach often seems like a bottomless pit.	☐	☐
25. My weight has hardly changed at all in the last ten years.	☐	☐
26. I am always hungry so it is hard for me to stop eating before I finish the food on my plate.	☐	☐
27. When I feel lonely, I console myself by eating.	☐	☐
28. I consciously hold back at meals in order not to gain weight.	☐	☐
29. I sometimes get very hungry late in the evening or at night.	☐	☐
30. I eat anything I want, any time I want.	☐	☐
31. Without even thinking about it, I take a long time to eat.	☐	☐
32. I count calories as a conscious means of controlling my weight.	☐	☐
33. I do not eat some foods because they make me fat.	☐	☐
34. I am always hungry enough to eat at any time.	☐	☐
35. I pay a great deal of attention to changes in my figure.	☐	☐
36. While on a diet, if I eat a food that is not allowed, I often then splurge and eat other high calorie foods.	☐	☐

Part II

Directions: Please answer the following questions by circling the number above the response that is appropriate to you.

37. How often are you dieting in a conscious effort to control your weight?

1	2	3	4
rarely	sometimes	usually	always

38. Would a weight fluctuation of 5 lbs affect the way you live your life?

1	2	3	4
not at all	slightly	moderately	very much

39. How often do you feel hungry?

1	2	3	4
only at mealtimes	sometimes between meals	often between meals	almost always

40. Do your feelings of guilt about overeating help you to control your food intake?

1	2	3	4
never	rarely	often	always

41. How difficult would it be for you to stop eating halfway through dinner and not eat for the next four hours?

1	2	3	4
easy	slightly difficult	moderately difficult	very difficult

42. How conscious are you of what you are eating?

1	2	3	4
not at all	slightly	moderately	extremely

43. How frequently do you avoid 'stocking up' on tempting foods?

1	2	3	4
almost never	seldom	usually	almost always

44. How likely are you to shop for low calorie foods?

1	2	3	4
unlikely	slightly likely	moderately likely	very likely

45. Do you eat sensibly in front of others and splurge alone?

1	2	3	4
never	rarely	often	always

46. How likely are you to consciously eat slowly in order to cut down on how much you eat?

1	2	3	4
unlikely	slightly likely	moderately likely	very likely

47. How frequently do you skip dessert because you are no longer hungry?

1	2	3	4
almost never	seldom	at least once a week	almost every day

48. How likely are you to consciously eat less than you want?

1	2	3	4
unlikely	slightly likely	moderately likely	very likely

49. Do you go on eating binges though you are not hungry?

1	2	3	4
never	rarely	sometimes	at least once a week

50. On a scale of 0 to 5, where 0 means no restraint in eating (eating whatever you want, whenever you want it) and 5 means total restraint (constantly limiting food intake and never 'giving in'), what number would you give yourself?
Circle ONE.

0
eat whatever you want, whenever you want it

1
usually eat whatever you want, whenever you want it

2
often eat whatever you want, whenever you want it

3
often limit food intake, but often 'give in'

4
usually limit food intake, rarely 'give in'

5
constantly limiting food intake, never 'giving in'

51. To what extent does this statement describe your eating behaviour? 'I start dieting in the morning, but because of any number of things that happen during the day, by evening I have given up and eat what I want, promising myself to start dieting again tomorrow'.

1	2	3	4
not like me	little like me	pretty good description of me	describes me perfectly

Appendix Four

Child Feeding Questionnaire

1. Mother's ID ☐☐☐☐ ☐☐☐

CHILD FEEDING QUESTIONNAIRE

2. Today's date ☐☐ ☐☐ ☐☐
   day month year

Mother's name

Address

3. Mother's date of birth ☐☐ ☐☐ ☐☐
   day month year

Father's name

4. Father's date of birth ☐☐ ☐☐ ☐☐
   day month year

Child's name

Other names

5. Child's date of birth ☐☐ ☐☐ ☐☐
   day month year

6. Sex of child Male ☐

   Female ☐

7. Is this your first child? Tick Yes ☐ or No ☐ Enter ☐

8. If not, please give the age of any other children you have had, who are living with you now.

   Male children ☐☐ ☐☐ ☐☐ ☐☐ years

   Female children ☐☐ ☐☐ ☐☐ ☐☐ years

9. Did you ever put your baby to the breast?
(Answer yes even if it was only once)

Tick Yes ☐ or No ☐ Enter ☐

10. If yes, how old was your baby when you last breast fed him/her?

Either ☐☐ months

or ☐☐ weeks and ☐☐ days

11. How old was your baby when he/she first had any food apart from milk?

☐☐ weeks old

12. Do you tend to feed your child at set times?

Tick Yes ☐ or No ☐ Enter ☐

13. Do you believe that children should be allowed to eat whenever they are hungry?

Yes, always ☐ 1

Usually ☐ 2

Sometimes ☐ 3

Occasionally ☐ 4

No, rarely or never ☐ 5 Enter ☐

14. Do you allow your child to have snacks in-between meals?

Yes, always ☐ 1

Usually ☐ 2

Sometimes ☐ 3

Occasionally ☐ 4

No, rarely or never ☐ 5 Enter ☐

15. Do you tend to reward your child if he/she has eaten all or nearly all of their meal?

Tick Yes ☐ or No ☐ Enter ☐

16. If yes, what type of rewards do you use? (Tick as appropriate)

Non-food, non-tangible rewards, e.g. praise ☐1 Enter ☐

Non-food, tangible reward, e.g. toys ☐2 Enter ☐

Puddings, biscuits etc. ☐3 Enter ☐

Confectionery ☐4 Enter ☐

Fruit ☐5 Enter ☐

Other ☐6 Enter ☐

If other, please state ☐

17. Do you ever eat any food from your child's plate to encourage him/her to eat it?

Tick Yes ☐ or No ☐ Enter ☐

18. If yes, how often do you do this?

Most mealtimes ☐1

Some mealtimes ☐2

or very occasionally ☐3 Enter ☐

19. Do you find your child particularly easy, about average or particularly difficult to feed for a child his/her age?

Easy ☐1

Average ☐2

Difficult ☐3 Enter ☐

20. How would you describe the variety of foods that your child generally eats?
Does he/she

Eat most things ☐ 1

Eat a reasonable variety of things ☐ 2

or is he/she a fussy or faddy eater? ☐ 3 Enter ☐

21. For a child of his/her age, does he/she have

A good appetite ☐ 1

An average appetite ☐ 2

or a poor appetite? ☐ 3 Enter ☐

22. In general, do you consider your child was easy to wean from milk?

Tick Yes ☐ or No ☐ Enter ☐

23. In general, do you tend to feed your child on home-prepared meals?

Tick Yes ☐ or No ☐ Enter ☐

24. Do you use manufactured baby-foods?

Usually ☐ 1

Sometimes ☐ 2

Often ☐ 3

Rarely ☐ 4

Never ☐ 5 Enter ☐

25. Do you consider your child to be:-

Overweight ☐ 1

Slightly overweight ☐ 2

About correct weight ☐ 3

Slightly underweight ☐ 4

Underweight ☐ 5 Enter ☐

26. How important do you think it is for children to have the following:-
(Tick as appropriate)

	Not important	Important	Very important	
a. Wide variety of foods	☐1	☐2	☐3	Enter ☐
b. Plenty to drink	☐1	☐2	☐3	Enter ☐
c. Low sugar intake	☐1	☐2	☐3	Enter ☐
d. Additive-free foods	☐1	☐2	☐3	Enter ☐
e. Low salt intake	☐1	☐2	☐3	Enter ☐
f. High fibre intake	☐1	☐2	☐3	Enter ☐
g. Low fat intake	☐1	☐2	☐3	Enter ☐
h. Plenty of calories	☐1	☐2	☐3	Enter ☐

27. Do you avoid giving your child any of the following types of food, and food ingredients:-
(Tick as appropriate)

	Usually avoid	Sometimes avoid	Rarely avoid	
a. Salty foods	☐1	☐2	☐3	Enter ☐
b. Sugar	☐1	☐2	☐3	Enter ☐
c. Fatty foods	☐1	☐2	☐3	Enter ☐
d. Artificial colours	☐1	☐2	☐3	Enter ☐
e. Natural colours	☐1	☐2	☐3	Enter ☐
f. Preservation-antioxidants	☐1	☐2	☐3	Enter ☐
g. Flavourings	☐1	☐2	☐3	Enter ☐
h. Gluten	☐1	☐2	☐3	Enter ☐
i. Lactose	☐1	☐2	☐3	Enter ☐

ABOUT YOU

28. How old were you when you finished full-time education?

16 or under	☐ 1	
17	☐ 2	
18	☐ 3	
19 or over	☐ 4	Enter ☐

29. What qualifications have you obtained at school or college?

no formal qualifications	☐ 1	
CSE (or equivalent)	☐ 2	
'O' level (or equivalent)	☐ 3	
GCSE	☐ 4	
'A' level	☐ 5	
degree	☐ 6	
other (please specify below	☐ 7	Enter ☐

☐

30. What was your current (or last) form of paid employment?
(Please write in job title)

☐

31. Is/was this full or part-time work?

full-time	☐ 1	
part-time	☐ 2	Enter ☐

32. What do (did) you actually do?
Please describe your job

☐

33. What does the firm or organisation you work for make or do?

☐

34. Are (were) you a manager or supervisor of any kind?

Yes, manager ☐1

Yes, supervisor ☐2

No, neither ☐3 Enter ☐

35. Do you have the use of a car?

Tick Yes ☐ or No ☐ Enter ☐

36. Do you have a telephone?

Tick Yes ☐ or No ☐ Enter ☐

37. Does your household own or rent this house or flat?

Owns - with mortgage or loan or outright ☐1

Rents local authority/new town ☐2

housing association ☐3

privately unfurnished ☐4

privately furnished ☐5

from employer ☐6

other with payment ☐7

Tied house ☐8

Rent free ☐9 Enter ☐

ABOUT YOUR PARTNER

38. How old was your partner when he finished full-time education?

16 or under	☐ 1	
17	☐ 2	
18	☐ 3	
19 or over	☐ 4	Enter ☐

39. What qualifications did your partner obtain at school or college?

no formal qualifications	☐ 1	
CSE (or equivalent)	☐ 2	
'O' level (or equivalent)	☐ 3	
GCSE	☐ 4	
'A' level	☐ 5	
degree	☐ 6	
other (please specify below	☐ 7	Enter ☐

☐

40. What is/was his current (or last) form of paid employment?

Please write in his job title

☐

41. Is/was this full or part-time work?

full-time	☐ 1	
part-time	☐ 2	Enter ☐

42. What does (did) your partner actually do?

Please describe his job

☐

43. What does the firm or organisation he works for make or do?

44. Is (was) he a manager or supervisor of any kind?

Yes, manager	☐ 1	
Yes, supervisor	☐ 2	
No, neither	☐ 3	Enter ☐

Appendix Five

Instructions for Behavioural Coding Inventory

Instructions for Behavioural Coding Inventory

Do not rewind video tape when coding. Accuracy of the timing on the computer record depends on continuous coding of the meal from start to finish.

There may be problems coding when the mother is feeding the child and the child is also feeding itself at the same time, and/or when different substances are involved. Give preference to coding feeding actions, i.e. do not miss feeding actions in order to code substance.

Substance

Enter substance at the beginning of feed and thereafter only if substance is changed.

Enter sweet code when mother switches from savoury to sweet (N.B. difficult for a few children who are given sweet and savoury simultaneously).

Texture of food

The texture of the food served during observation is classified as either *purée, semi-solid* or *solid* according to the overall dish, rather than individual substances within it. For example, roast chicken served with peas and mashed potatoes would be classified as *solid.* The distinction between *solids* and *semi-solids* is made mainly by consistency. For example, chicken, peas and mashed potatoes could be classified as *semi-solid* if the consistency makes it difficult to put in the *solids* category. Baby jars of food and any other food which has a uniform consistency is classified as a *purée.* Toddler jars of food will be classified as *semi-solids.* Examples of this classification can be seen in the table below.

Purée	**Semi-solid**	**Solid**
Baby jars, packets etc. Ice cream Yoghurt Fromage frais Mousse	Toddler jars Rice pudding Tapioca pudding Yoghurt with fruit	Most foods which are not puréed Tinned spaghetti Soup e.g. Scotch Broth

Feeding

Do not code the mother placing food or drink in front of child.

Accept must always be preceded by *give*, never by *hand.*

Refusals are sometimes ambiguous, e.g. when child keeps mouth shut on being offered food but does not turn head away, etc. Code as *refuse* unless infant has clearly not noticed the spoon. If infant has not noticed the spoon before it is withdrawn code as *withdraw*.

Drinking

Use the appropriate codes as for food intake. The substance is coded beforehand which will identify what the child is drinking

Use *release* code when child finishes drinking from bottle/cup if child has removed the cup from mouth unassisted by the mother.

Use *takeoff* if the mother removes the bottle/cup from the child's mouth.

Sundry

If an incorrrect code is entered, press e (for *error*) then enter correct code. When checking files delete mistake and enter correct code at appropriate time.

Appendix Six

Example of a behavioural coding output file

Behavioural coding output for meal number two (2) (File name: PDUN051b.obs)

= = =	14:33:49.01	27-05-1997
2 * x	14:33:56.16	27-05-1997
2 * z	14:33:56.70	27-05-1997
2 * o	14:34:08.07	27-05-1997
2 * g	14:34:09.72	27-05-1997
2 * a	14:34:10.22	27-05-1997
2 * o	14:34:18.18	27-05-1997
2 * g	14:34:18.51	27-05-1997
2 * a	14:34:19.11	27-05-1997
2 * o	14:34:29.33	27-05-1997
2 * g	14:34:29.66	27-05-1997
2 * a	14:34:30.10	27-05-1997
2 * o	14:34:43.28	27-05-1997
2 * g	14:34:43.61	27-05-1997
2 * a	14:34:44.16	27-05-1997
2 * o	14:34:58.06	27-05-1997
2 * g	14:34:58.39	27-05-1997
2 * a	14:34:58.99	27-05-1997
2 * o	14:35:13.65	27-05-1997
2 * g	14:35:14.04	27-05-1997
2 * a	14:35:14.48	27-05-1997
2 * o	14:35:25.35	27-05-1997
2 * g	14:35:26.45	27-05-1997
2 * a	14:35:42.77	27-05-1997
2 * o	14:36:04.63	27-05-1997
2 * g	14:36:04.90	27-05-1997
2 * a	14:36:05.28	27-05-1997
2 * o	14:36:15.78	27-05-1997
2 * g	14:36:16.05	27-05-1997
2 * a	14:36:16.65	27-05-1997
2 * l	14:36:22.37	27-05-1997
2 * b	14:36:22.59	27-05-1997
2 * g	14:36:23.36	27-05-1997
2 * a	14:36:23.90	27-05-1997
2 * t	14:36:33.02	27-05-1997
2 * x	14:36:40.55	27-05-1997
2 * z	14:36:40.88	27-05-1997
2 * o	14:36:41.26	27-05-1997
2 * g	14:36:41.87	27-05-1997
2 * a	14:36:42.36	27-05-1997
2 * o	14:36:54.28	27-05-1997
2 * g	14:36:54.61	27-05-1997
2 * a	14:36:55.05	27-05-1997

2 * o	14:37:03.23	27-05-1997
2 * g	14:37:03.51	27-05-1997
2 * a	14:37:03.89	27-05-1997
2 * o	14:37:12.84	27-05-1997
2 * g	14:37:13.17	27-05-1997
2 * a	14:37:13.89	27-05-1997
2 * o	14:37:23.66	27-05-1997
2 * g	14:37:23.99	27-05-1997
2 * a	14:37:24.71	27-05-1997
2 * o	14:37:31.46	27-05-1997
2 * g	14:37:31.79	27-05-1997
2 * a	14:37:32.18	27-05-1997
2 * o	14:37:40.47	27-05-1997
2 * g	14:37:40.80	27-05-1997
2 * a	14:37:41.62	27-05-1997
2 * o	14:38:01.73	27-05-1997
2 * g	14:38:02.06	27-05-1997
2 * a	14:38:02.44	27-05-1997
2 * o	14:38:10.19	27-05-1997
2 * g	14:38:10.41	27-05-1997
2 * a	14:38:10.90	27-05-1997
2 * o	14:38:20.07	27-05-1997
2 * g	14:38:20.40	27-05-1997
2 * a	14:38:21.01	27-05-1997
2 * o	14:38:29.02	27-05-1997
2 * g	14:38:29.35	27-05-1997
2 * a	14:38:30.12	27-05-1997
2 * o	14:38:52.31	27-05-1997
2 * g	14:38:52.70	27-05-1997
2 * a	14:38:53.25	27-05-1997
2 * o	14:39:01.60	27-05-1997
2 * g	14:39:01.93	27-05-1997
2 * a	14:39:02.36	27-05-1997
2 * o	14:39:08.63	27-05-1997
2 * g	14:39:08.90	27-05-1997
2 * a	14:39:09.29	27-05-1997
2 * o	14:39:15.82	27-05-1997
2 * g	14:39:16.37	27-05-1997
2 * a	14:39:16.76	27-05-1997
2 * o	14:39:23.51	27-05-1997
2 * g	14:39:23.84	27-05-1997
2 * a	14:39:24.22	27-05-1997
2 * o	14:39:32.68	27-05-1997
2 * g	14:39:33.01	27-05-1997
2 * a	14:39:33.40	27-05-1997
2 * o	14:39:43.23	27-05-1997
2 * g	14:39:43.56	27-05-1997
2 * a	14:39:43.89	27-05-1997
2 * o	14:39:53.56	27-05-1997

2 * g	14:39:53.83	27-05-1997
2 * a	14:39:55.42	27-05-1997
2 * o	14:40:05.58	27-05-1997
2 * g	14:40:05.91	27-05-1997
2 * a	14:40:06.30	27-05-1997
2 * o	14:40:16.90	27-05-1997
2 * g	14:40:17.50	27-05-1997
2 * a	14:40:17.94	27-05-1997
2 * o	14:40:28.82	27-05-1997
2 * g	14:40:29.64	27-05-1997
2 * a	14:40:30.03	27-05-1997
2 * o	14:40:41.23	27-05-1997
2 * g	14:40:41.51	27-05-1997
2 * a	14:40:41.89	27-05-1997
2 * o	14:40:49.47	27-05-1997
2 * g	14:40:49.80	27-05-1997
2 * a	14:40:50.18	27-05-1997
2 * o	14:41:00.84	27-05-1997
2 * g	14:41:01.28	27-05-1997
2 * a	14:41:01.94	27-05-1997
2 * o	14:41:12.10	27-05-1997
2 * g	14:41:12.32	27-05-1997
2 * a	14:41:12.65	27-05-1997
2 * o	14:41:28.47	27-05-1997
2 * g	14:41:28.69	27-05-1997
2 * a	14:41:29.07	27-05-1997
2 * o	14:41:37.86	27-05-1997
2 * g	14:41:38.13	27-05-1997
2 * a	14:41:38.68	27-05-1997
2 * l	14:41:48.73	27-05-1997
2 * b	14:41:49.01	27-05-1997
2 * g	14:41:51.26	27-05-1997
2 * a	14:41:51.92	27-05-1997
2 * t	14:41:55.27	27-05-1997
2 * x	14:41:58.95	27-05-1997
2 * z	14:41:59.17	27-05-1997
2 * o	14:41:59.66	27-05-1997
2 * g	14:41:59.88	27-05-1997
2 * a	14:42:00.27	27-05-1997
2 * o	14:42:07.57	27-05-1997
2 * g	14:42:07.85	27-05-1997
2 * a	14:42:08.51	27-05-1997
2 * o	14:42:16.36	27-05-1997
2 * g	14:42:16.64	27-05-1997
2 * a	14:42:17.57	27-05-1997
2 * o	14:42:26.08	27-05-1997
2 * g	14:42:26.41	27-05-1997
2 * a	14:42:26.85	27-05-1997
2 * c	14:45:03.44	27-05-1997

2 * d	14:45:03.83	27-05-1997
2 * o	14:45:17.73	27-05-1997
2 * g	14:45:18.16	27-05-1997
2 * a	14:45:19.21	27-05-1997
2 * o	14:45:25.31	27-05-1997
2 * g	14:45:25.63	27-05-1997
2 * a	14:45:25.96	27-05-1997
2 * o	14:45:33.10	27-05-1997
2 * g	14:45:33.38	27-05-1997
2 * a	14:45:33.82	27-05-1997
2 * o	14:45:40.19	27-05-1997
2 * g	14:45:40.41	27-05-1997
2 * a	14:45:40.79	27-05-1997
2 * o	14:45:46.78	27-05-1997
2 * g	14:45:47.11	27-05-1997
2 * a	14:45:47.50	27-05-1997
2 * o	14:46:12.49	27-05-1997
2 * g	14:46:12.71	27-05-1997
2 * a	14:46:13.04	27-05-1997
2 * o	14:46:19.41	27-05-1997
2 * g	14:46:19.74	27-05-1997
2 * a	14:46:21.16	27-05-1997
2 * o	14:46:29.07	27-05-1997
2 * g	14:46:29.57	27-05-1997
2 * a	14:46:30.83	27-05-1997
2 * o	14:46:38.85	27-05-1997
2 * g	14:46:39.07	27-05-1997
2 * a	14:46:39.45	27-05-1997
2 * o	14:46:46.65	27-05-1997
2 * g	14:46:46.92	27-05-1997
2 * a	14:46:47.36	27-05-1997
2 * o	14:46:55.82	27-05-1997
2 * g	14:46:56.15	27-05-1997
2 * a	14:46:56.87	27-05-1997
2 * o	14:47:05.38	27-05-1997
2 * g	14:47:06.09	27-05-1997
2 * a	14:47:07.14	27-05-1997
2 * o	14:47:17.19	27-05-1997
2 * g	14:47:17.46	27-05-1997
2 * a	14:47:17.85	27-05-1997
2 * o	14:47:25.76	27-05-1997
2 * g	14:47:26.09	27-05-1997
2 * a	14:47:26.53	27-05-1997
2 * o	14:47:35.86	27-05-1997
2 * g	14:47:36.14	27-05-1997
2 * a	14:47:36.63	27-05-1997
2 * o	14:47:46.63	27-05-1997
2 * g	14:47:46.96	27-05-1997
2 * a	14:47:52.29	27-05-1997

2 * o	14:48:03.33	27-05-1997
2 * g	14:48:03.77	27-05-1997
2 * a	14:48:04.64	27-05-1997
2 * o	14:48:16.78	27-05-1997
2 * g	14:48:17.11	27-05-1997
2 * a	14:48:17.55	27-05-1997
2 * o	14:48:30.40	27-05-1997
2 * g	14:48:30.95	27-05-1997
2 * a	14:48:31.50	27-05-1997
2 * o	14:48:42.98	27-05-1997
2 * g	14:48:43.37	27-05-1997
2 * a	14:48:43.92	27-05-1997
2 * o	14:48:55.01	27-05-1997
2 * g	14:48:55.34	27-05-1997
2 * a	14:48:55.72	27-05-1997
2 * o	14:49:03.58	27-05-1997
2 * g	14:49:03.91	27-05-1997
2 * a	14:49:04.68	27-05-1997
2 * o	14:49:15.50	27-05-1997
2 * g	14:49:15.77	27-05-1997
2 * a	14:49:16.60	27-05-1997
2 * o	14:49:26.59	27-05-1997
2 * g	14:49:26.92	27-05-1997
2 * a	14:49:27.36	27-05-1997
2 * o	14:49:35.27	27-05-1997
2 * g	14:49:35.55	27-05-1997
2 * a	14:49:36.09	27-05-1997
2 * o	14:49:43.84	27-05-1997
2 * g	14:49:45.38	27-05-1997
2 * a	14:49:45.71	27-05-1997
2 * o	14:49:53.23	27-05-1997
2 * g	14:49:53.56	27-05-1997
2 * a	14:49:54.11	27-05-1997
2 * o	14:50:02.79	27-05-1997
2 * g	14:50:03.12	27-05-1997
2 * a	14:50:03.61	27-05-1997
2 * o	14:50:12.84	27-05-1997
2 * g	14:50:13.11	27-05-1997
2 * a	14:50:13.55	27-05-1997
2 * o	14:50:26.52	27-05-1997
2 * g	14:50:26.96	27-05-1997
2 * a	14:50:27.51	27-05-1997
2 * o	14:50:37.28	27-05-1997
2 * g	14:50:37.61	27-05-1997
2 * a	14:50:38.05	27-05-1997
2 * o	14:50:51.40	27-05-1997
2 * g	14:50:52.28	27-05-1997
2 * a	14:50:52.88	27-05-1997
. . .	14:51:15.13	27-05-1997

Appendix Seven

Example of an SPSS command file

SPSS COMMAND FILE: 'knp.com'

```
TITLE ANALYSIS OF                                    /*this file
                                                     /*knp.com
SET WIDTH=80
FILE HANDLE r1 / Name 'whit081b.rl'
FILE HANDLE r2 / Name 'whit081b.rl2'
FILE HANDLE r3 / Name 'whit081b.rl3'
FILE HANDLE r4 / Name 'whit081b.rl4'
DATA LIST FILE=r1 RECORDS=1
 /1 id 1-2 act 7 (a)  time 10-20 (time) date 23-32 (date) id 34-41 (id)

This command will read 1 records from whit081b.rl

FORMAT TIME (F11.2)
VARIABLE LABELS  TIME 'TIME OF ACT'

print outfile=r2
/id act time date

COMPUTE FIRSTACT=64655.32
COMPUTE TIMESECS=TIME-FIRSTACT

print outfile=r3
/id act time date timesecs
print outfile=r4
/ act timesecs

COMPUTE PREV=LAG(TIME,1)
COMPUTE PINT=TIME-PREV
COMPUTE LNPINT=LN(PINT)
COMPUTE ACT0 =0
COMPUTE ACT1 =0
COMPUTE ACT2 =0
COMPUTE ACT3 =0
COMPUTE ACT4 =0
COMPUTE ACT5 =0
COMPUTE ACT6 =0
COMPUTE ACT7 =0
COMPUTE ACT8 =0
COMPUTE ACT9 =0
COMPUTE ACT10=0
COMPUTE ACT11=0
COMPUTE ACT12=0
COMPUTE ACT13=0
COMPUTE ACT14=0
COMPUTE ACT15=0
COMPUTE ACT16=0
COMPUTE ACT17=0
COMPUTE ACT18=0
COMPUTE ACT19=0
COMPUTE ACT20=0
```

```
COMPUTE ACT21=0
COMPUTE ACT22=0
COMPUTE ACT23=0
COMPUTE ACT24=0
COMPUTE ACT25=0

RECODE  ACT  ('x'=1)   (else=0) into act1
RECODE  ACT  ('c'=1)   (else=0) into act2
RECODE  ACT  ('l'=1)   (else=0) into act3
RECODE  ACT  ('q'=1)   (else=0) into act4
RECODE  ACT  ('p'=1)   (else=0) into act5
RECODE  ACT  ('d'=1)   (else=0) into act6
RECODE  ACT  ('z'=1)   (else=0) into act7
RECODE  ACT  ('o'=1)   (else=0) into act8
RECODE  ACT  ('f'=1)   (else=0) into act9
RECODE  ACT  ('u'=1)   (else=0) into act10
RECODE  ACT  ('b'=1)   (else=0) into act11
RECODE  ACT  ('g'=1)   (else=0) into act12
RECODE  ACT  ('h'=1)   (else=0) into act13
RECODE  ACT  ('w'=1)   (else=0) into act14
RECODE  ACT  ('t'=1)   (else=0) into act15
RECODE  ACT  ('m'=1)   (else=0) into act16
RECODE  ACT  ('a'=1)   (else=0) into act17
RECODE  ACT  ('s'=1)   (else=0) into act18
RECODE  ACT  ('r'=1)   (else=0) into act19
RECODE  ACT  ('j'=1)   (else=0) into act20
RECODE  ACT  ('n'=1)   (else=0) into act21
RECODE  ACT  ('k'=1)   (else=0) into act22
RECODE  ACT  ('v'=1)   (else=0) into act23
RECODE  ACT  ('i'=1)   (else=0) into act24
RECODE  ACT  ('e'=1)   (else=0) into act25

 VARIABLE LABELS
       act1  'Savoury'
       act2  'Sweet'
       act3  'Water or juice'
       act4  'Milk'
       act5  'Puree'
       act6  'Semisolid'
       act7  'Solid'
       act8  'Spoon'
       act9  'Finger'
      act10  'Bottle'
      act11  'Beaker'
      act12  'GIVES'
      act13  'HANDS'
      act14  'WITHDRAWS'
      act15  'TAKES OFF'
      act16  'MODELS'
      act17  'accepts'
      act18  'feed self'
      act19  'refuses'
      act20  'rejects'
      act21  'misses mouth'
```

```
    act22 'release'
    act23 'visible'
    act24 'invisible'
    act25 'error'

DESCRIPTIVE VARS=ACT0 TO ACT25
/STATISTICS=SUM

DESCRIPTIVE VARS=TIME
/STATISTICS=MAX MIN
```

Variable	Minimum	Maximum	N	Label
TIME	64644.88	66707.94	287	TIME OF ACT

Appendix Eight

Example of transcript of mother's verbal comments

ACOT 041 (21 minutes 43 seconds)

Meal 1

		Code
0	Are you drinking up?	L
1	You eat up then.	O
	You drink your milk.	O
	Right.	O
2	Here we go.	O
	This is yours.	O
	What's the matter?	N
	What?	N
	Here we go.	O
	Doesn't matter if the fingers are in it Thomas.	L
	You can get your fingers in.	L
	Are you going to be posh today and use your spoon?	L
	What?	N
	You eat it.	O
	That's a good lad.	J
	That's a very serious face.	N
3	Hee hee.	N
	Are you going to have some more?	O
	That's it.	J
	( )	Z
	What?	N
	I know, it doesn't live up there does it?	N
	All gone.	J
	That's right.	J

	What's the matter?	N
4		
	Are you going to use your spoon?	O
	That's it.	J
	That's a clever lad.	J
	That's right.	J
	Tasty tasty.	A
	What?	N
	Mmm.	A
	Oh, got it on your nose.	L
	Marvellous.	L
5		
	Let's put that bit in there.	D
	That's a big one.	L
	Oh, what a mess.	K
	What a mess.	K
	What are you?	K
6		
	Are you going to use your spoon?	O
	That's better.	J
	Oh dear me.	L
	What a mess.	L
	Are you going to have a drink now?	O
	Have a little drink.	O
	Good lad.	J
	Get this lot off.	D
	There we go.	D
7		
	Want your spoon?	O
	That's it.	J
	Good lad.	J

	Put it down.	K
	What a mess you're getting into.	K
	Mmmhmm.	N
	Use your spoon.	O
	That's it.	J
	Ohhh.	N
	Right.	O
	That was a good one.	K
	Wasn't it?	L
8	Are you going to use your spoon?	O
	Shake your dinner off, eh?	L
	What?	N
	What?	N
	Plant?	N
	Mmmhmm.	N
	There we go.	O
	Go on, are you going to put that in your mouth?	O
	You put it in your mouth.	O
	No?	L
9	You've dropped a bit.	L
	Dropped a few bits.	L
	Mucky pup.	L
	Mucky pup.	L
	No you have it.	O
	You eat it.	O
	You have it.	O

	Oh dear.	N
10		
	Oh dear.	N
	Never mind.	N
	What is it?	O
	It doesn't go there.	K
	Do you want a go?	O
	You'll poke yourself in the eye with that spoon.	K
	Oh dear me.	N
	Beg your pardon?	N
	Where's your sock?	N
	Where's your sock?	N
11		
	What?	N
	There you go.	O
	Oh, you're doing well there, Thomas.	J
	Go on then, you put it in.	O
	You eat it.	O
	Mmmhmm.	N
	Good lad.	J
	Good boy.	J
	Where's your spoon?	O
	That's it.	J
	Are you going to have some more?	O
12		
	Can it get in there?	O
	That's it.	O
	What's the matter?	N
	Are you going to have another drink?	O
	Lift it up.	O

	Tickle your toes.	N
	Tickly toes.	N
	I've got your tickly toes.	N
	What a good lad.	J
13		
	Mmmhmm.	N
	Kathryn's.	N
	What?	N
	That's that done.	N
	You dirty, dirty little dumpling.	N
	We don't usually get that far.	N
	Come on then.	N
	I'll try and get you cleaned up.	N
14		
	That's it.	N
	What a mess.	N
	Are you going to have your milk?	O
	Give me your dirty spoons.	N
	Can I have your dirty ones?	N
	Can I have that?	N
	There we go.	O
	You want that one?	O
	Okay.	L
15		
	I'll have that as well please?	N
	Mmmhmm.	N
	Funny face.	N
	Are you going to have some?	O
	That's it.	J

	You've got some on there you know?	O
	Are you going to eat it?	O
	No, you eat it.	O
	Oh stinker, aren't you?	N
	Oh scrummy.	A
	Scrummy.	A
	Scrummy.	A
16		
	Oops.	N
	Sorry Thomas.	N
	Oh look at you.	K
	You put it in your mouth.	O
	Yes you do it.	O
	I know.	N
	What a mess.	N
	You clean it up for Mammy.	N
	That's it, good lad.	J
	Is that a bit cold?	S
	Scrummy.	A
	Oh whee.	N
	Go on then.	O
17		
	You make it nice and tidy.	N
	Yes.	N
	Oh put it on your nose again Thomas.	N
	Come here.	N
	You will put your nose in the way, won't you?	N
	Oh was it a bit cold?	S
	It's a bit cold.	S

	Yes.	D
	What are you doing?	N
	Are you going to put your spoon in your mouth?	O
	Are you going to put it in your mouth?	O
18		
	Mmm.	A
	Give me, give me.	O
	I know what'll happen.	N
	You'll take it off me and throw it on the floor, won't you?	K
	Oh oh.	N
	You put it...	O
	Put it in your mouth then.	O
19		
	What?	N
	Good job I didn't clean the tablecloth, isn't it?	N
	Change the tablecloth.	N
	Oh Thomas.	K
	That's supposed to be in your mouth.	K
	Put it in your mouth.	O
	You're doing very well.	J
	You have a nice big drink.	O
	Ohh.	K
20		
	No.	K
	Ah Thomas.	K
	Get off.	K
	You.	K
	No.	K
	No.	K

	Yes I see what you've done.	K
	Come on.	K
	There's going to be trouble in a minute.	K
	Do you want some more?	O
	No?	L
	Have you had enough of this?	L
	That's it, you've had enough.	L
	Give it to Mammy then.	L
	Good lad.	J
	Right.	L
	Good lad.	J
	All done.	J
	You have another drink of milk then.	O
	What?	N
	There you go.	O
	You have that one.	O
	Okay?	O
21	Get a cloth.	N
	Right?	L
	Get this cleared up.	N

Appendix Nine

Instructions for Verbal Coding Inventory

Instructions for Verbal Coding Inventory

Coding the transcripts

All phrases are scored separately.

Both the video recording and the transcription are used when coding the comments into categories. The categories are decided upon taking the actual words, tone of voice, and the context in which they are said from up to five seconds before and five seconds after the utterance occurs.

Cognitive process for categorising comments:-

Is the comment about the child's eating behaviour?
Is the comment positive or negative?
If it cannot be coded as either positive or negative it is coded as neutral.

Is the comment about the food?
Is the comment positive or negative?
If it cannot be coded as either positive or negative it is coded as neutral.

Is the comment an offer of food or a prompt to eat the food?

Is the comment offering the child assistance in eating the food?

Is the comment about the child's condition in terms of satiety or thirst?

Is the comment about the mother's eating behaviour or preference for food?

Untranscribable comments all fall into a category of their own.

If the comment does not fall into any of the above categories, it is coded as a non-food comment.

Descriptions of categories forming the Verbal Coding Inventory

The categories forming the Inventory are printed in bold type face followed by the letter designated as its code in brackets.

Child's eating behaviour

Child's eating behaviour is defined as any comments referring to the way in which the child eats its food. Tone of voice is usually the decisive feature in coding these remarks.

Positive (J)

Defined as any positive comments referring to the child's eating behaviour including any comments about:

a) the child feeding or attempting to feed self
b) the child finishing off the food
c) the amount of food eaten

Negative (K)

Defined as any negative comments referring to the child's eating behaviour including any comments about:

a) the child making a mess
b) dropping food
c) eating too much food at once
d) child not using spoon
e) child not using spoon correctly

Neutral (L)

This category is defined as any comment about the child's eating behaviour which is said in a neutral way or does not fall into the positive or negative categories described above, including comments about:

a) the child using spoon
b) whether child has had enough to eat.

Food

Defined as any comment relating to the food being served at the observed meal. Comments about food which is not being served at the observed meal do not belong in this category.

Positive (A)

Defined as any positive comment or sound about the food being offered.

Negative (S)

Defined as any negative comment or sound about the food being offered.

Neutral (D)

Any comment about offered food which does not fall into the positive or negative food category.

Others

Verbal offers and prompts to eat (O)

A verbal offer is defined as the mother asking if the child would like food or drink to be served or fed to child regardless of quantity. A verbal prompt is defined as the mother encouraging the child to eat or drink more of a consumable. This category includes the mother attracting the child's attention, and includes comments about:

a) food offers
b) prompts

i) prompts to eat or drink
ii) prompts to draw attention to food being offered
iii) encouragement to finish consumable
iv) prompts encouraging self feeding/drinking
v) prompts to draw attention to unfinished food/drink
vi) bribes and threats
vii) prompts to drink

Offers of assistance (H)

Any comments which indicate that the mother will help the child physically to eat the food offered. This category includes comments the mother makes when handing a spoon to the child to facilitate self feeding, including comments about:

a) offers to help the child feed his/herself
b) offers to feed child

Child's condition (C)

Any comments about the child's physical condition in terms of hunger and satiety, and any comments connected to these conditions. Do not confuse this with comments about where child is sitting, whether the child is comfortable or not, etc.

Non-food comments (N)

Any comments which are not about food or eating, and do not fall into any other category. Use this category for any comments about food or eating behaviour related to other meals or other people. Any comments about medicine are included in this category. Comments the mother makes on the child's behalf are non-food comments, as well as comments the mother makes about spoons depending on its context. Also included are comments about the way the child is sitting.

Mother's eating (M)

Any comments which relate to the mother eating and her preferences for food.

Other (Z)

Comments which cannot be transcribed from the tape. These comments are indicated by (   ) on the transcripts.

Appendix Ten

Examples of plots of standardised residuals to test assumption of regression methods

Figure A1. Histogram of standardised residuals
Dependent variable : *intake* (g)

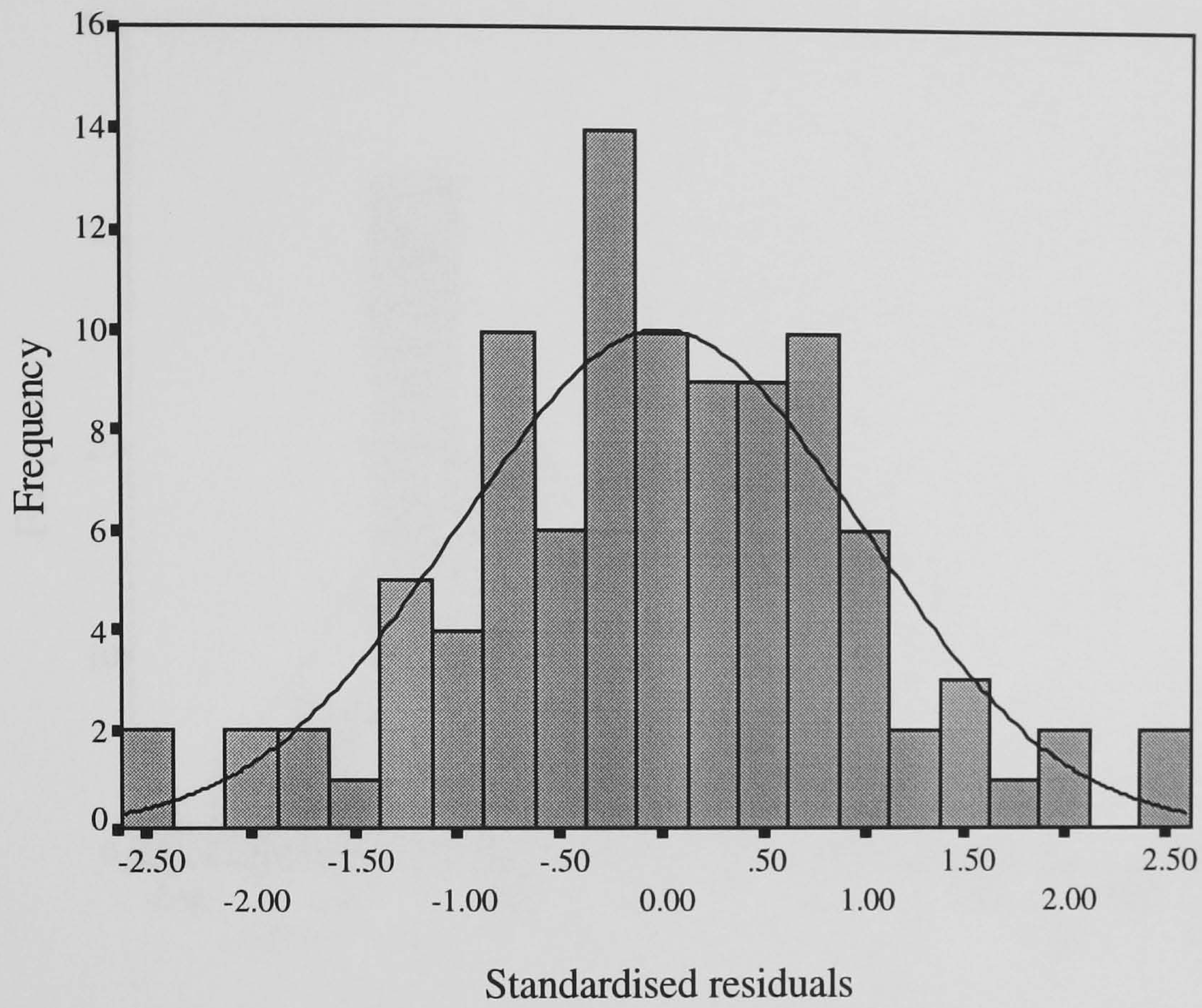

Figure A2. Normal P-P plot of standardised residuals
Dependent variable : *intake* (g)

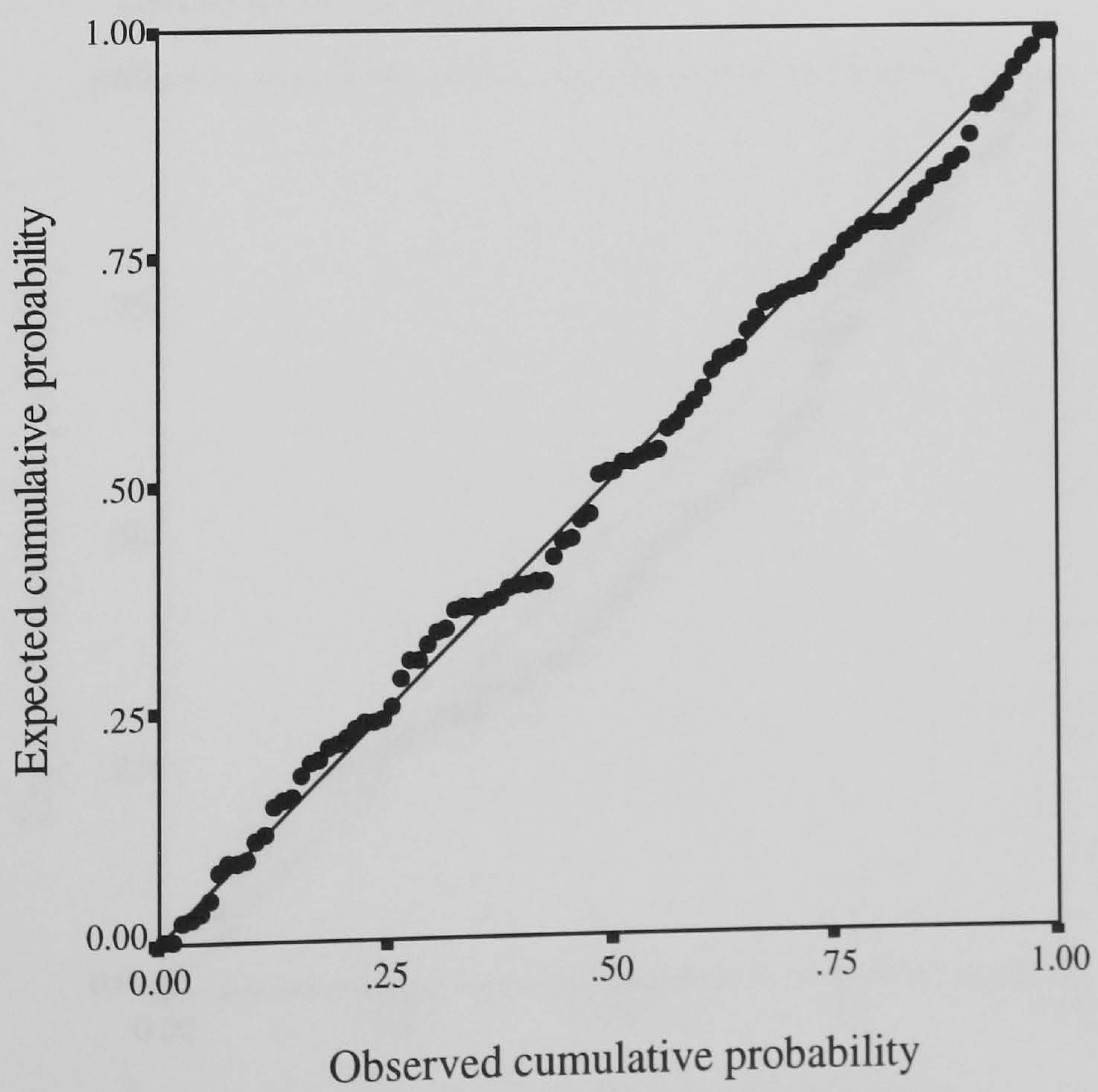

Figure A3. Histogram of standardised residuals
Dependent variable : *bites*

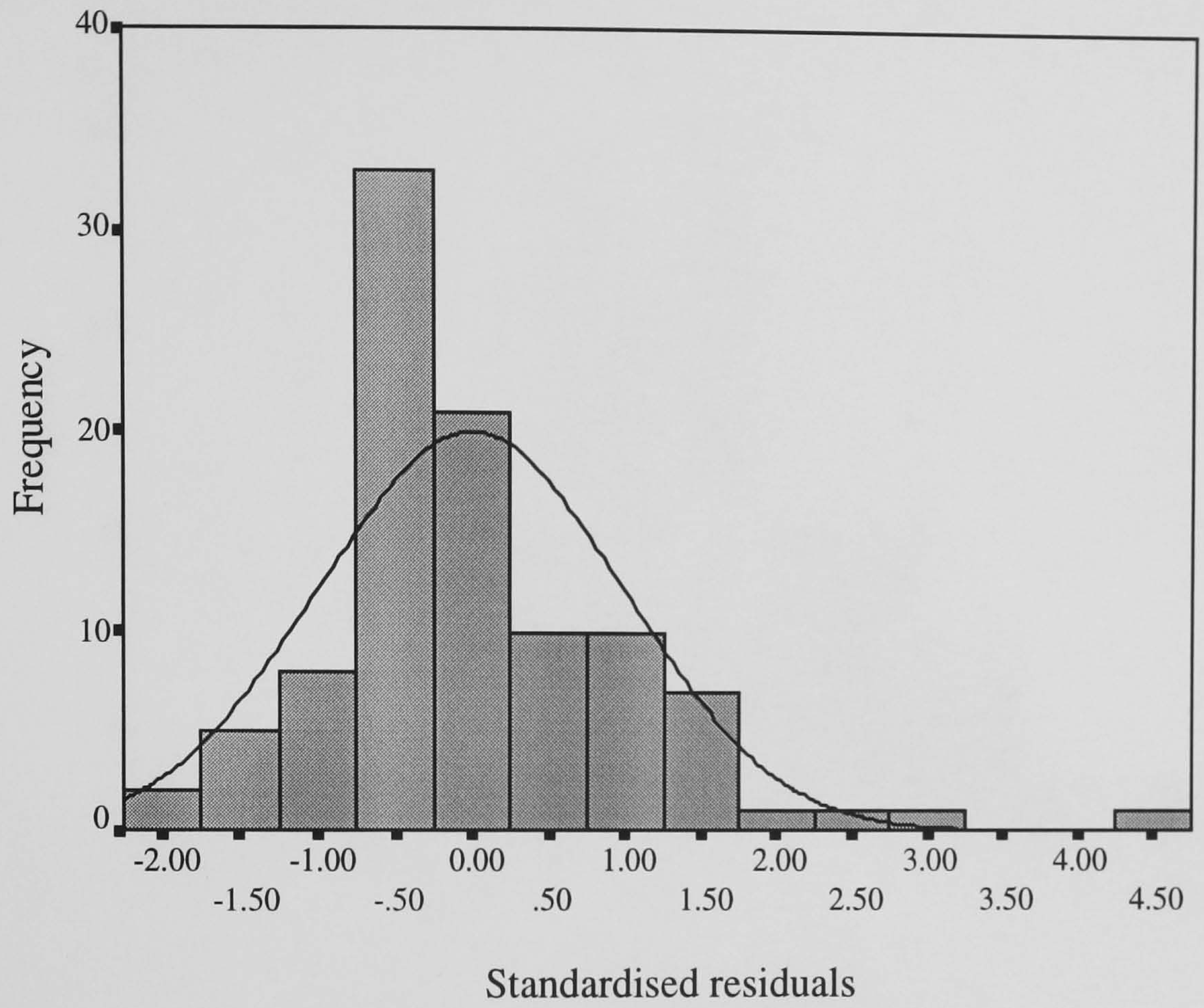

Figure A4. Normal P-P plot of standardised residuals
Dependent variable : *bites*

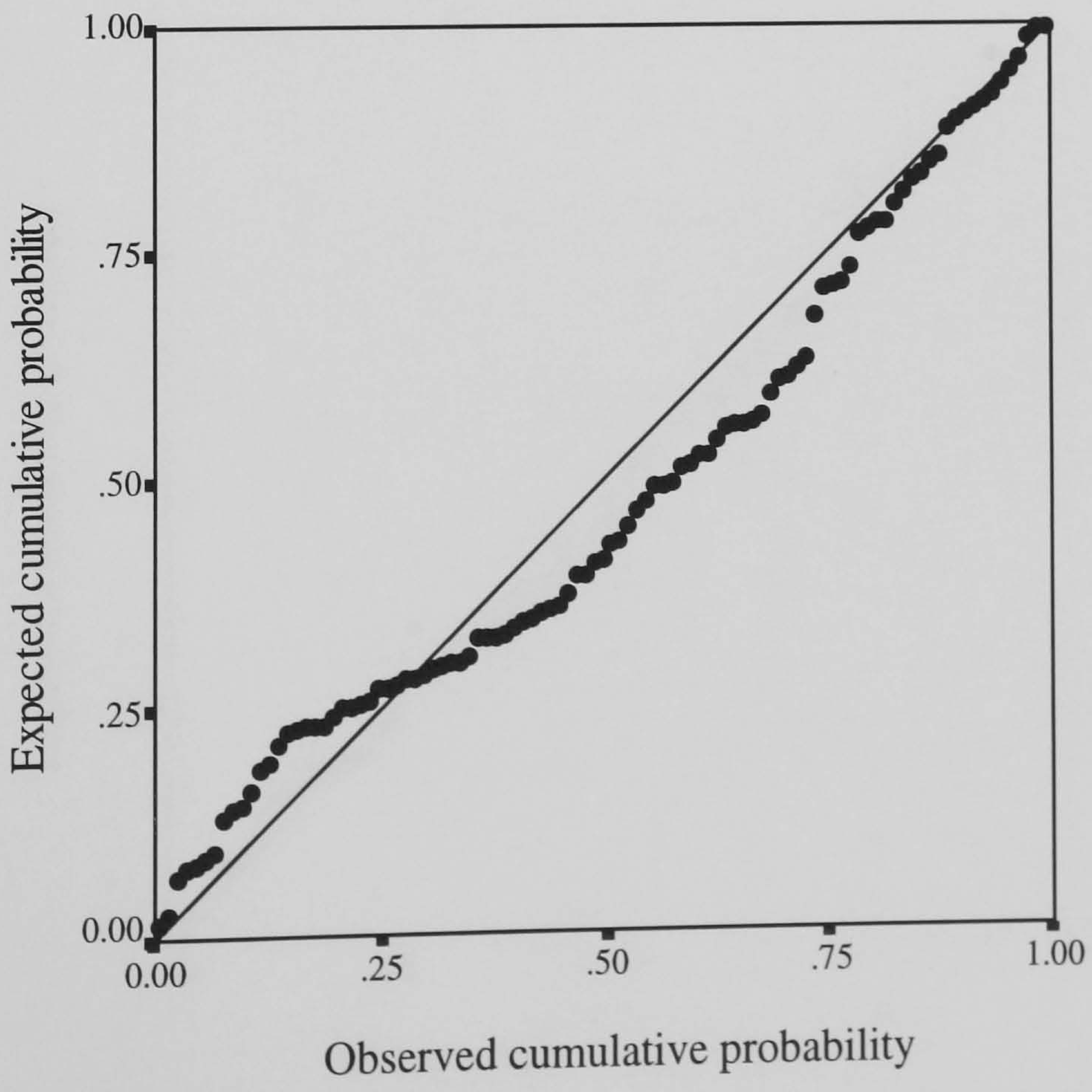

Figure A5. Histogram of standardised residuals
Dependent variable : logarithm of *bites*

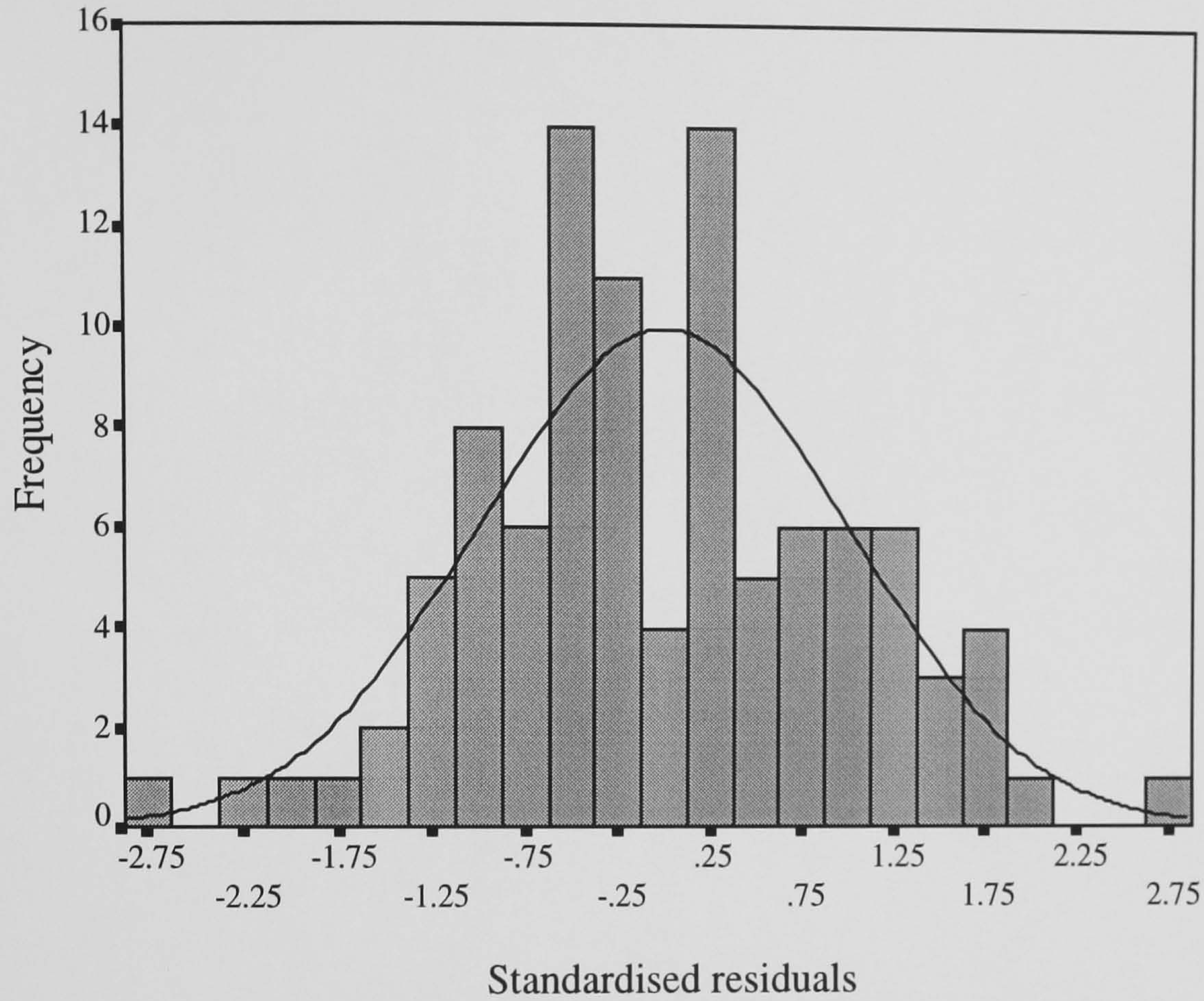

Figure A6. Normal P-P plot of standardised residuals
Dependent variable : logarithm of *bites*